PB-230 599

WATER RESOURCES ACTIVITIES IN THE UNITED STATES. FISH AND WILDLIFE AND WATER RESOURCES.

Select Committee on National Water Resources, U. S. Senate

April 1960

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

PB 230 599

86th Congress
2d Session

COMMITTEE PRINT NO. 18

WATER RESOURCES ACTIVITIES IN THE UNITED STATES

RECEIVED
LIBRARY
AUG 2 1960
FWPCA, OHIO BASIN REGIO
1676 COLUMBIA PKWY., CINTI. O

FISH AND WILDLIFE AND WATER RESOURCES

SELECT COMMITTEE ON NATIONAL WATER RESOURCES
UNITED STATES SENATE

PURSUANT TO

S. Res. 48

EIGHTY-SIXTH CONGRESS

APRIL 1960

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

Printed for the use of the Select Committee on National Water Resources

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1960

54875 O

SELECT COMMITTEE ON NATIONAL WATER RESOURCES

(Pursuant to S. Res. 48, 86th Cong.)

ROBERT S. KERR, Oklahoma, *Chairman*

THOMAS H. KUCHEL, California, *Vice Chairman*

DENNIS CHAVEZ, New Mexico
ALLEN J. ELLENDER, Louisiana
WARREN G. MAGNUSON, Washington
CLINTON P. ANDERSON, New Mexico
HENRY M. JACKSON, Washington
CLAIR ENGLE, California
PHILIP A. HART, Michigan
GALE W. McGEE, Wyoming
FRANK E. MOSS, Utah
JAMES E. MURRAY, Montana, ex officio

MILTON R. YOUNG, North Dakota
ANDREW F. SCHOEPPEL, Kansas
FRANCIS CASE, South Dakota
THOS. E. MARTIN, Iowa
HUGH SCOTT, Pennsylvania

PAUL McBRIDE, *Chief Clerk*
THEODORE M. SCHAD, *Staff Director*

STATEMENT BY THE CHAIRMAN

APRIL 28, 1960.

To the Members of the Select Committee on National Water Resources:

Under the provisions of Senate Resolution 48, the committee is directed to make exhaustive studies of the extent and character of water resources activities required to provide the quantity and quality of water needed by population, agriculture, and industry between the present time and 1980, along with suitable provision for related recreational and fish and wildlife values. As a means of helping the committee to meet its responsibilities in the latter field, I asked the Department of the Interior to prepare a report on fish and wildlife conservation requirements in connection with water resources development.

Fish and wildlife provides one of the important bases for one of our fastest growing industries—outdoor recreation. A survey made in 1955 shows that approximately $3 billion were spent by fishermen and hunters in that year in pursuit of their sports—an amount of about the same magnitude as the total annual electric bills of all the households of the United States. Fishermen and hunters spent 567 million man-days in the pursuit of their sport in that year, and traveled 10.4 billion miles by automobile on fishing and hunting trips. All of this makes a very important contribution to the economic activity of some of our States that are fortunately endowed with wildlife resources. Of even greater importance, fishing and hunting, along with other outdoor activities, are recognized medically as having great therapeutic values in the release of stresses and strains caused by the rapid pace of our modern life. In addition, the commercial fisheries in, and adjacent to the United States, represent an extremely important source of high protein food that makes an important contribution to our national diet.

The Fish and Wildlife Service of the Department of the Interior has prepared a report for us covering the place of fish and wildlife in our water resources development. The report points out that the problems of maintaining fish and wildlife resources are compounded by the combination of the rapidly increasing population and increase in leisure time available, with more and more people finding time for fishing and hunting activities, and the gradual and increasing encroachment of man's activities on the habitat available for fish and wildlife.

The report discusses the increases in demand for and decreases in availability of our fish and wildlife resources and explains the impact which many water-use projects have on these resources. Examples are given of the various types of projects, with discussion of how fish and wildlife conservation can be incorporated into many projects so as to give an overall beneficial effect. The present and projected water requirements for fish and wildlife are given, including those for our inland sports fisheries, for wildlife habitat, and for our commercial fisheries which are based in tidal estuaries along our seacoasts.

The report contains discussion of the problems involved in achieving adequate recognition for fish and wildlife in the water resources program, and contains recommendations as to general policy considerations which should be carried out to improve our fish and wildlife resources. Briefly stated, the report urges that fish and wildlife conservation and development should be considered as a coequal purpose with other purposes of water resources development in the United States in order that our future needs may be met. The importance of giving adequate recognition to the large economic values of the fish and wildlife resource and making adequate provision for it in allocations of cost are set forth. However, the report makes clear that dollar evaluations should not be the sole or even the dominant criteria used in making basic decisions on the nature of water resource development, since it must be

recognized that fish and wildlife and the values dependent on them may not always be susceptible of monetary measurements, and yet have significant and important nonmonetary values to the public.

The need for adequate land acquisition policies in connection with Federal reservoir sites is mentioned, as is the need for improved research and development efforts—particularly in the fields of fish farming, estuary and inland water improvement, management of fisheries, passage of fish over dams, replacement of wildlife habitat, and fishery product technology. In addition, the need for improvement of techniques of our marine fisheries is mentioned as one way of keeping up maximum production of this high value resource. Great emphasis is placed on the importance of tidal estuaries as breeding grounds for many species of fish, and the need for more research into the optimum use of our estuaries.

The report also suggests that as a general policy it should be recognized that some streams, lakes, and estuaries, or parts thereof, can contribute most to the Nation if left undeveloped by man except for purposes of fish and wildlife.

The report will be of interest to all members of the committee, to other Senators, and to all others interested in this aspect of our water resources development. Accordingly, I am having it printed as one of our series of committee prints covering all aspects of water resources activities in the United States.

ROB'T S. KERR,
Chairman, Select Committee on
National Water Resources.

COMMUNICATIONS

AUGUST 13, 1959.

Hon. FRED A. SEATON,
The Secretary of the Interior,
Department of the Interior, Washington, D.C.

MY DEAR MR. SECRETARY: Thank you for Acting Secretary Bennett's letter of July 24, enclosing a brief statement on water resource problems confronting the Department of the Interior, prepared in response to the request of the Senate Select Committee on National Water Resources. Among other problems discussed in the statement are those pertaining to recreation and fish and wildlife conservation.

In its studies of water resource activities in the United States under Senate Resoulution 48, the committee is charged with making suitable provisions for recreational and fish and wildlife values. While an exhaustive study of outdoor recreation, including the recreational aspects of water resources, is being made by the Outdoor Recreation Resources Review Commission, the results will not be available in time to be used by this committee. Accordingly, we are writing to ask that reports on recreational needs and fish and wildlife conservation requirements in connection with water resources development be prepared by the qualified agencies of the Department of the Interior.

Principal objective of each report should be to inform the committee on estimated needs in these fields by the years 1980 and 2000, and to present the Department's recommendations as to what needs to be done to accommodate the demands.

The report on recreational requirements should cover recent trends in demands for, water-using or water-related recreational services, distinguishing between 1 day or weekend use and annual vacation use, and unsatisfied demands. Projection of demands to 1980 and 2000 should be made, taking cognizance of the increasing trend toward urbanization and other economic, demographic, and social trends, and present and potential unsatisfied demands for recreational services. Present adequacy of facilities to meet these demands should be covered by region, recognizing both natural as well as artificially developed facilities. Estimated demands for water recreational facilities through 1980 should be discussed together with likely needs for water development to meet such needs, including quantitative and qualitative aspects of water supplies required.

We would also like to have an analysis of demands for water recreational activities of several typical metropolitan areas with recommendations for development to meet demands by 1980. Selection of cities should be worked out with the committee staff.

The report on fish and wildlife conservation in relation to water resources development should cover existing and projected future value of our fish and wildlife resources covering both commercial and noncommercial and intangible values. Relation of fishing and hunting to other recreational activities should be discussed together with the relation of fish and wildlife conservation activities to other water resources development activities. Estimated needs in this field through 1980 and looking ahead to the year 2000, including both quantitative and qualitative estimates of needs for water should be covered together with the Department's recommendations as to what measures should be taken between now and 1980 to meet these needs.

Each of the two reports should be not more than 10,000 words in length with whatever tables, charts, appendixes, and graphic illustrations as may be considered necessary. It would be most helpful if these reports could be furnished the committee by November 1, 1959. Projections of population and economic assumptions and regional boundaries on which the analyses should be based will be furnished by staff members of Resources for the Future, Inc., who are working cooperatively with the committee in developing water supply-demand relationships for all purposes. To assist them, we would like to

have information relating to the water supply and demand aspects made available to them informally during the course of your studies.

The committee staff will be glad to discuss any other problems which may arise in the preparation of the reports with representatives of the Department or of the agencies to which preparation of these reports is assigned.

Sincerely yours,

ROB'T S. KERR, *Chairman.*

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C., March 31, 1960.

Hon. ROBERT S. KERR,
Chairman, Select Committee on National Water Resources,
U.S. Senate, Washington, D.C.

DEAR SENATOR KERR: We are pleased to transmit herewith a report prepared by the Fish and Wildlife Service of this Department on water in relation to fish and wildlife for the consideration of the Senate Select Committee on National Water Resources. This letter will summarize the report and present the recommendations prepared by the Service.

People of the Nation are turning to outdoor recreation as a use of leisure time in tremendously increasing numbers. A large proportion of outdoor recreation which they demand is based on the waters of our streams, lakes, reservoirs, and littoral areas. Much of the stimulus for this demand is, in turn, based on the Nation's fish and wildlife resources and the fishing and hunting which they provide.

The commercial fisheries of the Nation are also of great and growing importance. They enrich our diet, providing vitamins, minerals, and other needed elements for health. Moreover, fish taken in the commercial catch are a source of vital raw materials for the manufacture of drugs, and are used for other industrial purposes, such as ingredients in mixed feeds for poultry and swine. The welfare of a large segment of the commercial fishing industry depends on favorable water management and the availability of adequate quantities and qualities of water in our lakes and rivers and, especially, in our estuaries.

The Fish and Wildlife Act of August 8, 1956 (70 Stat. 1119), gave new and greater recognition to the importance of fish and wildlife resources in the programs and policies of the Federal Government. In accordance with the authority provided by that act, the Department has strengthened materially its fish and wildlife conservation programs. However, this is becoming an ever more difficult task because of the growing demands on our water and related land resources from the expanding population, industry, and agriculture. These demands are rapidly changing the habitat of the Nation's fish and game. At the same time, as suggested above, the demands of the American people for fish and wildlife for both recreation and food are growing at a rate far faster than population. This puts tremendous pressure on our fish and game resources from two opposite directions. Full recognition in water resource development policy of the needs of fish and wildlife for water and related land resources is essential to their survival. The amendments to the Fish and Wildlife Coordination Act enacted in 1958 (Public Law 85-624) provide an excellent foundation for this recognition, but there is a need for adoption of related policies and legislation.

An expanding population will demand more sport fishing, more hunting, and a greater supply of fish for food. Meeting these needs would logically retire more fresh water, but water supplies are already inadequate in some places and chances of greatly increasing the supply are slight. The most logical solution is better utilization of the available water by sharing it equitably, keeping it clean and providing for its multiple use. We must design water projects to benefit and not harm fish and wildlife. We must obtain biological facts about commercial and sport species which will enable us to produce more of them with less water. We must find better ways to manage fish and wildlife resources to minimize

the effects of manmade changes in their habitat. We should explore the seas to find new sources of food fishes which are not dependent on supplies of fresh water.

Fortunately, water needed by these resources is generally not consumed in serving fish and wildlife conservation needs. Accordingly, provision of adequate supplies for fish and game does not remove much from the supply available for other beneficial uses. Nevertheless, water in adequate quantity and of suitable quality must be available throughout the Nation for the survival of these resources.

In accordance with the assumptions presented in the underlying report, the water requirements for fish and wildlife in the basic years of 1954, 1980, and 2000, for which figures have been requested by your committee, are estimated as follows:

[Thousands of acre feet]

Item	1954	1980	2000
Fishery:			
Sport	89,000	195,700	273,500
Commercial	30,930	49,790	73,900
Estuarine	1,010,000	1,010,000	1,010,000
Wildlife	95,903	167,705	191,717

The principal problem in gaining adequate recognition of the need of fish and wildlife for water is that the body of law and related policy governing the development of water resources in the United States has been built up largely without regard to the needs of fish and wildlife. There has been generated a notion that the "development" phases of water programs have a particular right to the Nation's water. Moreover, the "select" association of water resource development purposes, such as irrigation, hydroelectric power, flood control, and navigation, has established itself in many minds as objectives of Federal water programs superior to fish and wildlife conservation.

This situation is nowhere more apparent than in the lack of recognition accorded to fish and wildlife in the water laws of the States. State water law generally does not support the major responsibility of the State governments for the management and administration of fish and resident game. It has been stated, authoritatively, that fish and wildlife uses are dependent on the "leavings" of water in State water law, especially in Western water law.

Provision for adequate recognition for fish and wildlife resources in the disposition of the Nation's water supply does not have to mean restriction in water development for other purposes. As a matter of fact, water resource development for irrigation, hydroelectric power, navigation, and other traditional purposes can result in substantial benefits to fish and wildlife—if it is recognized in the planning and construction of water projects that conservation is a coequal objective. It is not necessary to "lock up" water resources as Nature made them in streams and lakes to preserve fish and wildlife. But there must be full recognition of the fact that measures for the preservation and enhancement of fish and wildlife resources incorporated in water developments are not free or even cheap. Substantial costs for conservation of these resources must be accepted fully and freely as a part of overall project costs if adequate recognition of fish and wildlife values in water resource development is to be achieved. This cannot be accomplished if second-class status is accorded to fish and wildlife conservation as a true purpose of project development in, for example, the computation of benefits and allocations. Furthermore, measurement in dollars of fish and wildlife values is difficult because those values are primarily esthetic.

In a few cases, there is need for recognition that rivers, lakes, and estuaries in their natural state contribute most to public benefit by being left that way, without impoundment, diversion, or channelization. The need is for *optimum* development of our water resources, rather than for *maximum* development.

Quality of water is of particular significance to the conservation of fish and wildlife. One of the beneficial uses of water is for the disposal of waste. Nevertheless, industries and cities have, in many cases, overused the water resources of the Nation for this purpose, to the detriment of fish and wildlife. Pollution has visited its most obvious ill effects on the living resources dependent on water.

One of the great needs for fish and wildlife conservation in connection with water resources is more research. The acquisition of basic knowledge about the effects of water resource development on the welfare of fish and game is essential in order to provide for the continued existence of these resources in the inevitable alteration of water and land habitat. For example, knowledge of the basic fundamentals of reservoir fishery management must be increased so that the thousands of impoundments which will be constructed and which have already been constructed will better serve the outdoor recreation demands of the Nation. Too little is known about this subject to permit these manmade lakes to serve the recreational purposes they should.

Likewise, far too little is known about the effects of channelization and dredging in the estuaries along our coastlines on the tremendous fish and wildlife resources which depend on them for livelihood. These shallows and inshore waters serve as spawning and nursery grounds for many of our most important commercial and sports fishes. There is a huge program of dredging and filling going forward in the estuaries for navigation and real estate and industrial development purposes. Conservation agencies are handicapped in coping with the problem by imperfect knowledge of the fundamental relationship of changes in estuarine environment to production of fish and wildlife resources.

So too, with the problem of passage of anadromous fish over high dams. These fish, including salmon, steelhead trout, and shad, are spawned in fresh water, migrate to the sea where they spend most of their adult lives, and return to the streams of their origin to spawn and reproduce their kind. They have been blocked in their migrations by dams. Some success has been achieved in devising facilities to permit their passage over dams 100 feet or less in height. However, not nearly enough is known about the design of facilities to permit their safe passage, upstream and downstream, over higher dams. Meanwhile, there is growing need to build large storage reservoirs, with high dams, in river basins where anadromous fish are especially important, particularly in the Pacific Northwest and in Alaska. There is urgent requirement for research to develop the facilities for fish passage so that the needed water storage developments can be provided without destroying these important runs of fish.

In view of the material presented here and in the attached report, the following recommendations are presented for the consideration of the Senate Select Committee on National Water Resources. These recommendations do not constitute specific legislative proposals; they are merely for policy consideration in this field. It is recommended:

1. That each water project, as authorized for construction, include adequate provision for fish and wildlife conservation and development as a project purpose in accordance with the letter and spirit of the Fish and Wildlife Coordination Act.

2. That until such time as an improved method of evaluation is adopted, the use of sportsmen's expenditures as a basis for evaluation of benefits be accepted by all concerned with project formulation and authorization.

3. That costs allocated to fish and wildlife conservation on Federal water projects computed under the separable cost-remaining benefits method be accepted by all working in the field of fish and wildlife, flood control, irrigation, and other project purposes, and that there be no attempt to limit such cost allocations artificially and arbitrarily.

4. That dollar evaluation should not be the sole or even the dominant criterion used in making basic decisions on the nature of water resource development. This would recognize that fish and wildlife, and certain other resources which may not always be susceptible of monetary measurement, have significant and important nonmonetary values to the public.

5. That the supplement to the land acquisition policy adopted and announced in 1959 by the Departments of the Army and Interior, attached hereto as appendix D, be adhered to in the formulation and authorization of Federal water projects.

6. That the optimum utilization of the fresh water available for fish and wildlife be recognized as vital; this will require improved research and development efforts, particularly in the fields of fish farming, estuary and inland water improvement, management of fisheries, passage of fish over dams, replacement of wildlife habitat, and fishery product technology.

7. That the need for maximum production to meet increased demands for consumption of ocean fishes, which do not require fresh water, be recognized by all affected interests; this also will require improved research and development efforts, particularly in the fields of fishing gear and methods, exploratory fishing, marine biology, oceanography and technology, and economics including distribution and marketing of fishery products.

8. That as a general policy it be recognized that some streams, lakes, and estuaries, or parts thereof, can contribute most to the Nation if left undeveloped by man except for purposes of fish and wildlife.

Sincerely yours,

FRED A. SEATON, *Secretary of the Interior.*

54875 O—60——2

CONTENTS

	Page
Statement by the chairman	III
Communications	V
Chapter I. Importance of fish and wildlife	1
Commercial fisheries	2
Sport fisheries and wildlife	2
Congressional recognition	3
Administration of fish and wildlife conservation	4
State conservation activities	5
Chapter II. Fish and wildlife in relation to water resources	8
Greater demand for fish and wildlife	8
Demand for commercial fishery products	8
A problem	8
Possible solutions	8
Recreational demand for fish and wildlife	9
The basic problem	10
Effects of land-use programs	11
Effects of water resources programs	12
The basic solution	14
Impact of water-use projects on fish and wildlife resources	16
Dam and reservoir construction	17
Effect on anadromous fish	18
Effect on wildlife	18
Other effects of reservoirs	18
Example: Middle Snake River Dams, Idaho-Oregon	20
Channelization	22
Example: Mississippi River-Gulf Outlet project, Louisiana	23
Dredging and filling	24
Example: Delaware River channelization project, Pennsylvania-New Jersey	25
Pollution and siltation	25
Example: The Roanoke River, Va.-N.C.	27
Diversions for industry, irrigation, and other human uses	28
Example: The Garrison diversion unit, North Dakota	30
Example: The Columbia Basin project, Washington	31
Leveeing	31
Example: Saginaw River flood control project, Michigan	32
Drainage	33
Example: Drainage of Prairie Pothole region, North Dakota, South Dakota, and Minnesota	33
Small watershed projects	34
Example: Flat Creek watershed project, Arkansas	35
Highway construction	35
Saline barriers	37
Example: Saline barrier, San Francisco Bay, Calif.	37
Reservation from development	38
Example: The Current River, Ark. and Mo.	39
Chapter III. Future demand for fish and wildlife resources	39
Sport fisheries and wildlife	39
Commercial fisheries	41
Chapter IV. Water requirements for fish and wildlife	44
Inland sports fishery	44
Wildlife	44
Commercial fisheries	45

Chapter V. Problems in achieving adequate recognition for fish and wildlife in the water resources program ..... Page 46
Fish and wildlife command less economic power 47
Evaluation of fish and wildlife benefits 47
Sportsmen's expenditure method 47
Allocation of project costs to fish and wildlife 48
Reimbursement of fish and wildlife costs 49
Public access to water projects 50
Drainage of wetlands 51
Passage of anadromous fish over high dams 52
The skimmer device 54
Need for research 55
Lack of recognition for fish and wildlife in State water laws 55
Research in reservoir management 56
Estuarine research 56

TABLES

1. Data on U.S. Fish and Wildlife Service 5
2. Estimated number of hunters, days hunted, and hunter's expenditures in 1954, 1980, and 2000 41
3. Estimated numbers of sport fishermen, days fished, and fishermen's expenditures in 1954, 1980, and 2000 42
4. Pounds and value of commercial catch of fresh-water-dependent species in 1954 42
5. Projected pounds and value of commercial catch of fresh-water-dependent species in 1980 43
6. Projected pounds and value of commercial catch of fresh-water-dependent species in 2000 43
7. Estimated water requirements for wildlife and sport fishery resources by major U.S. river basins in 1954, 1980, and 2000 45
8. Estimated water requirements for inland commercial and estuarine fishery resources by major U.S. river basins in 1954, 1980, and 2000 46
9. The value in 1954 of wetlands to waterfowl, based on State-unit determinations 51

APPENDIXES

A. Fish and Wildlife Coordination Act 59
B. Watershed Protection and Flood Prevention Act 62
C. Fish and Wildlife Act of 1956 64
D. Joint policy for land acquisition on reservoir projects, Department of the Army-Department of the Interior 68
E. Marine Game Fisheries Research Act 69

FISH AND WILDLIFE AND WATER RESOURCES

Chapter I. Importance of Fish and Wildlife

Fish and wildlife are living natural resources of great value to the Nation. Like other living things, fish and wildlife must have adequate, suitable water. The demands of our growing population and economy for water for industry, agriculture, and municipal purposes threaten to take away the water living space of fish and game. In the further development and use of our water resources, a share of the Nation's water must be provided for fish and wildlife if they are to survive.

A great deal is at stake in that survival. Since colonial days, when the first settlers depended heavily on fish and game for their food supply, fish and wildlife resources have been vitally important to our economy and way of living. The commercial fishing industry still provides an essential part of the national diet. The recreational value of fish and game is essential to human well-being.

We measure progress, in our fast-moving civilization, in terms of growth of our cities and towns, expansion of industrial output, new housing starts, high birth rate, and increases in gross national product. We are a prosperous, bustling Nation. At the same time, we are shocked by the physical and emotional breakdown of men and women in their prime, resulting from the stress of modern-day living. Adequate opportunities for fishing and hunting and related forms of outdoor recreation are the finest antidotes for stress. Fish and wildlife conservation equates very closely with the conservation of human resources, the most important of all.

The commercial fisheries provide employment for about a half million people in the United States. These are tuna fishermen.

Fishing and hunting in the outdoors are better antidotes for modern-day stresses than the use of tranquilizer pills, but the opportunity to fish and hunt will not automatically remain. Fish and wildlife resources must have a share of the water resource pie.

The Nation's commercial fishing fleet represents a pool of seafaring experience vital to the Nation.

COMMERCIAL FISHERIES

Fish and wildlife resources have commercial values as well as values for the mind, the body, and the spirit.

The fishing industry of the United States is a significant part of our economy. The fish harvested commercially from our rivers, lakes, and seas provide a valuable source of protein food for the diet of Americans. They enrich our diet and promote our health, providing vitamins, minerals, and other dietary requirements in wider variety than any other class of foods. The commercial fisheries of the Nation provide employment, both direct and indirect, for about half a million people. Fish taken in the commercial catch are tremendous sources of raw materials for the manufacture of drugs, for other industrial uses, and as ingredients in mixed feeds for livestock and poultry. Fish which enter into commercial channels create wages and profits for the whole chain of commercial distribution from canner to wholesaler to the neighborhood supermarket. Moreover, the commercial fishing fleet helps to maintain the seafaring tradition of the Nation. About 12,250 commercial fishing vessels, 5 net tons or over, and their crews represent a pool of maritime know-how and facilities which the Nation needs.

In 1954 the U.S. commercial fishing industry produced nearly 5 billion pounds of basic product, valued at $356 million.[1] Of these amounts, somewhat more than 61 percent of the volume (2.9 million pounds) and 58 percent of the value ($208 million) were accounted for by aquatic species which are dependent on fresh water during part or all of their lifetime. Retail value amounts to about 2½ times the basic amount, or about $500 million of product each year from fresh-water-dependent species.

In addition to the strictly fresh-water species, there are important anadromous fishes, such as salmon and striped bass, which ascend the streams from the ocean to spawn. There are others which live in the brackish waters of estuaries along the seashore and still others, such as shrimp and menhaden, which spend the crucial period of their young lives in the nearly freshwater heads of estuaries. The existence of these species depends upon the vital supply of fresh water to their environment.

The 1954 commercial catch of fresh-water-dependent species was composed of the following:

[In thousands]

Species	Landed weight	Value to fisherman
	Pound	
Fresh water	218,153	$20,999
Anadromous	397,956	47,902
Estuarine dependent	2,304,289	130,379

To this supply from commercial sources must be added the substantial sport-caught volume which is now estimated by the Sport Fishing Institute to exceed 1 billion pounds annually. Of this, about three-fourths are composed of fresh-water species.

U.S. commercial production of fresh-water-dependent species in 1954 represented a substantial proportion—about 6 percent—of the world production of all fishery products.

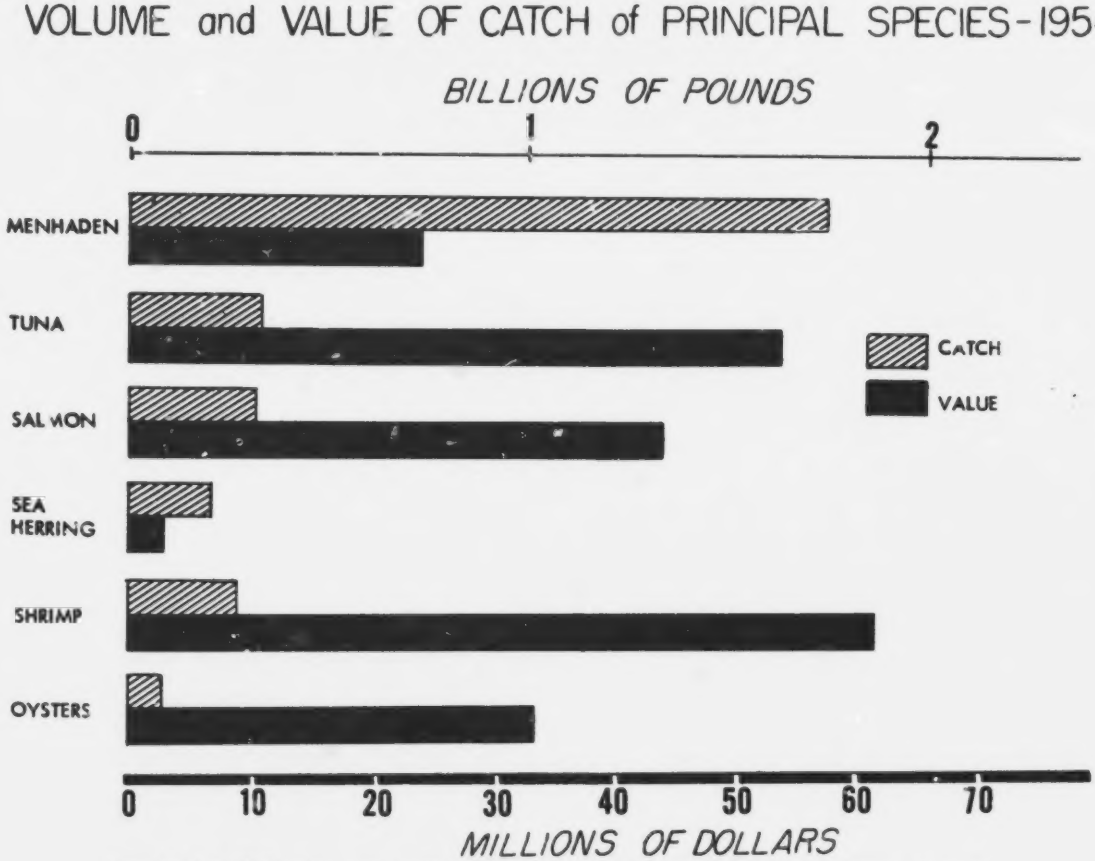
A tabulation of volume and value of product from fresh-water-dependent species by water resource area is presented in chapter III of this report.

Every person in the Nation has an interest in the welfare of the commercial fishing industry, whether it is to provide him with good food at low cost, to sustain payrolls in his community, or to help provide for defense of the Nation from potential seaborne aggression.

SPORT FISHERIES AND WILDLIFE

The recreational use of fish and game resources also has important economic values. A nationwide survey made for calendar year 1955 showed that one out of every three households in the United States included one or more fishermen or hunters. One in every five persons, 12 years of age or more, fished or hunted during that year; this amounted to 25 million people in that age category. One in every four men fished, and one in every five hunted. Approximately $3 billion were spent by fishermen and hunters in 1955 in pursuit of their sports. This amount is about the same as that spent in 1955 by all of the households in the United States for residential electricity. Fishermen and hunters spent 567 million man-days and traveled 10.4 billion miles by automobile on fishing and hunting trips.

[1] The year 1954 is used here because of the request of the Senate Select Committee on National Water Resources to furnish figures on water demands for that year, 1980, and the year 2000



Commercial fisheries are important sources of food and revenue. Salmon require clean fresh-water; menhaden, shrimp, and oysters require clean estuarine waters.

A special survey of nonresident elk hunters in Wyoming illustrates how important one sports activity can be to the economy of a State. The Game and Fish Department found in 1955 that nonresident hunters spent an average of $471 each in the pursuit of elk. Considering that 2,500 such licenses were issued, it can be assumed that over $1 million was realized by merchants of goods and services to this small group alone.

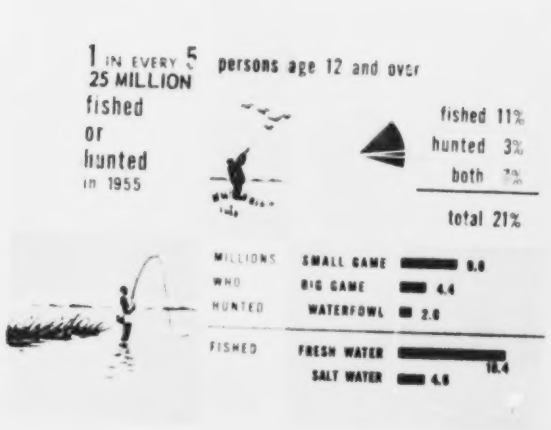
The figures noted above from the national survey, of course, do not represent the total value of sports fisheries and wildlife in the United States. Millions of people expend a great deal of money to enjoy fish and wildlife in their outdoor recreation without bringing fish or game to creel or bag.

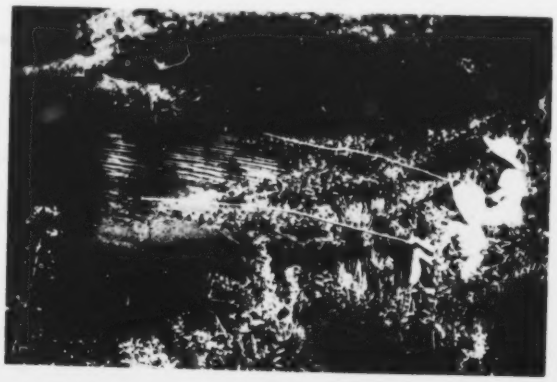
It is clear that fishing and hunting are major activities of Americans and that expenditures for these outdoor sports represent an important source of income to the business community of the United States. These expenditures provide employment and profits not only for the industries manufacturing and merchandising fishing and hunting equipment, but also for the automobile and related industries, for the boat industry, motels, restaurants, resorts, and other businesses.

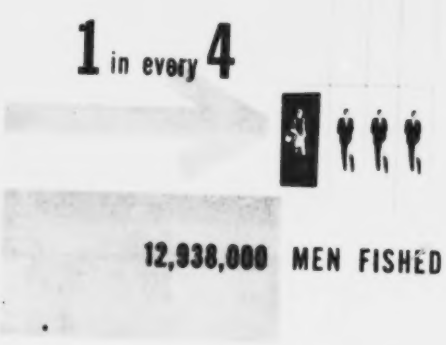
CONGRESSIONAL RECOGNITION

The Congress itself recognized the growing importance of fish and wildlife resources to the Nation and the necessity of expanded programs for their conservation by passage of the Fish and Wildlife Act of August 8, 1956 (70 Stat. 1119). In the opening lines of this statute—

> The Congress hereby declares that the fish, shellfish, and wildlife resources of the Nation make a material contribution to our national economy and food supply, as well as a material contribution to the health, recreation,







Fishing opportunity is an American tradition which must be preserved. The chart is taken from the National Survey of Fishing and Hunting, 1955.

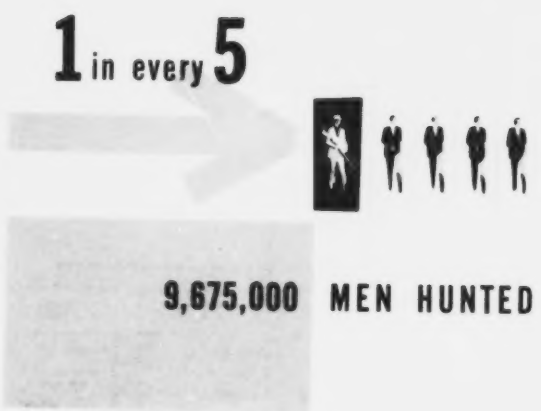
These results are from the National Survey of Fishing and Hunting, 1955.

and well-being of our citizens; that such resources are a living, renewable form of national wealth that is capable of being maintained and greatly increased with proper management, but equally capable of destruction if neglected or unwisely exploited * * *.

ADMINISTRATION OF FISH AND WILDLIFE CONSERVATION

The Fish and Wildlife Act of 1956 greatly raised the stature of fish and wildlife conservation activities in the Federal Government. The activity began with the establishment of the Bureau of Fisheries in the Department of Commerce in 1871 and was followed by the establishment of the Bureau of Biological Survey in the Department of Agriculture in 1885. The two agencies were combined to form the Fish and Wildlife Service in the Department of the Interior in 1940.

The Fish and Wildlife Act of 1956 established within the Department of the Interior the position of Assistant Secretary for Fish and Wildlife and the U.S. Fish and Wildlife Service, headed by a Commissioner. Within the Service are two separate bureaus, as called for by the act; one is the Bureau of Commercial Fisheries and the other is the Bureau of Sport Fisheries and Wildlife. Under the law, the Bureau of Commercial Fisheries is responsible for Federal programs relating primarily to commercial fisheries, including whales, seals, and sea lions. The Bureau of Sport Fisheries and Wildlife is responsible for Federal functions, including research, relating primarily to migratory birds, game management, wildlife ref-



Hunting is one of America's most popular forms of recreation. The chart represents one of the results from the National Survey of Fishing and Hunting, 1955.

uges, and sport fisheries in both fresh and salt waters.

The accompanying organization chart indicates the functional structure of the U.S. Fish and Wildlife Service. The related maps depict the regional-organization of the two bureaus. Table 1 presents basic information on the facilities, personnel, and annual expenditures of the Service.

The Fish and Wildlife Act of 1956 includes a number of directives and authorities designed to strengthen the services of the Federal Government for the commercial fishing industry and to foster

TABLE 1.—*Data on U.S. Fish and Wildlife Service*

INSTALLATIONS [1]

Unit	Number	States (number)	Area (acres)
Bureau of Sport Fisheries and Wildlife:			
Big game and migratory bird refuges	274	[2] 45	17,269,582
National fish hatcheries	101	42	17,224
Wildlife research centers	2	2	.....
Fishery research stations	13	13	.....
Administrative sites [3]	27	4	.....
Bureau of Commercial Fisheries:			
Pribilof Islands reservation	1	1	50,163
Fishery laboratories	26	[2] 15	.....
Lamprey control stations	108	3	.....

FISCAL YEAR 1960 PROGRAM [4]

Bureau of Sport Fisheries and Wildlife	$54,764,886
Bureau of Commercial Fisheries	23,122,665
Commissioner's Office	340,000
Total	78,227,551

PERMANENT PERSONNEL [5]

	Total personnel
Commissioner's Office	35
Bureau of Sport Fisheries and Wildlife:	
Central office (Washington, D.C.)	325
Pacific region	610
Southwest region	489
North-central region	468
Southeast region	446
Northeast region	257
Alaska region	67
Total, Bureau of Sport Fisheries and Wildlife	2,662
Bureau of Commercial Fisheries:	
Central office (Washington, D.C.)	181
Pacific region	420
Gulf and South Atlantic region	236
North Atlantic region	264
Great Lakes and central region	113
Alaska	127
California program area office	72
Hawaii, program area office	63
Total, Bureau of Commercial Fisheries	1,476
Total, U.S. Fish and Wildlife Service	4,173

[1] As of June 30, 1959.
[2] And Puerto Rico.
[3] Facilities are used by both Bureaus in some instances.
[4] Includes funds received from all sources.
[5] As of Dec. 31, 1959.

sport fisheries and wildlife programs on a continuing and expanding basis. A copy of the act is included in the appendix to this report. The intent of the Congress was clarified with respect to sport fisheries in both fresh and salt water by the act of September 22, 1959 (73 Stat. 642). This act directed the Secretary of the Interior to initiate a program of salt water sport fishery research. A copy of this act is also appended.

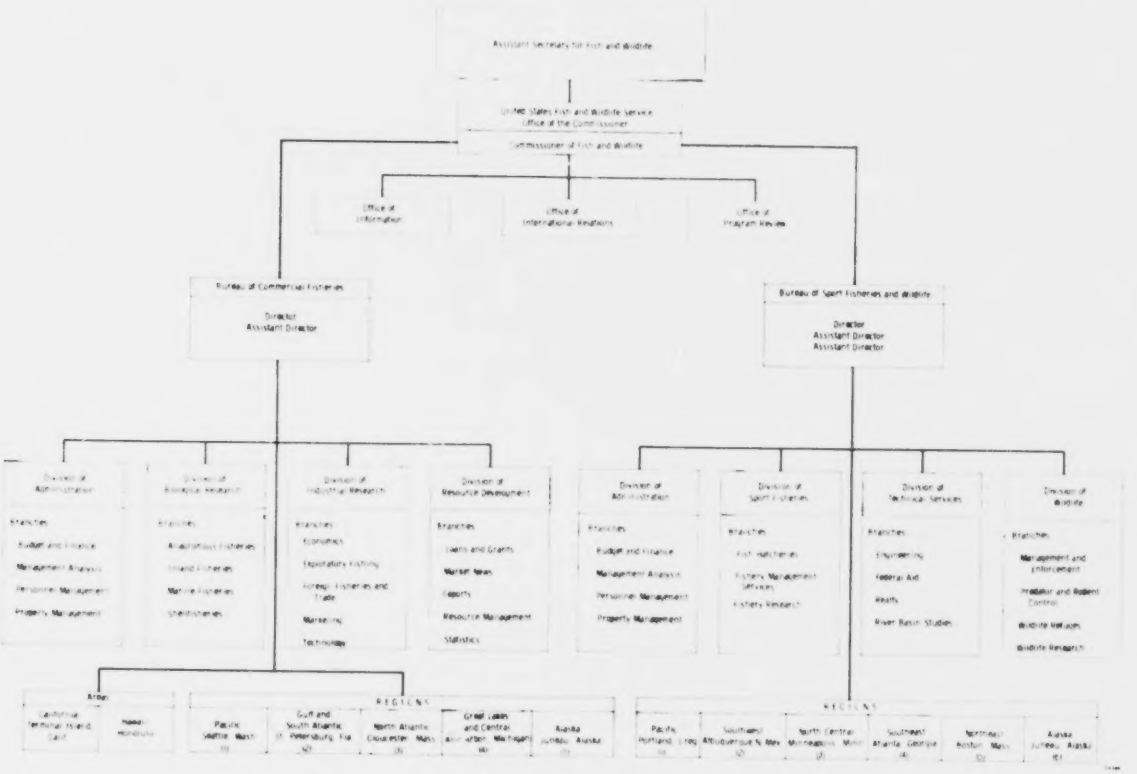
State conservation activities

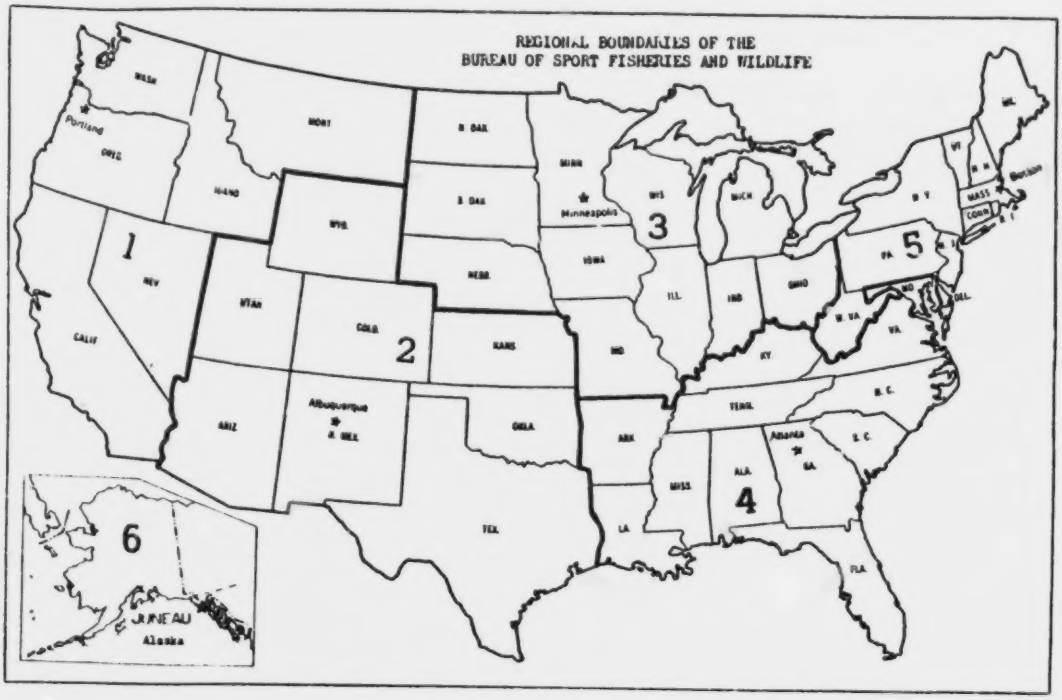
The State governments play a highly important role in the conservation and management of the Nation's fish and game resources. Every one of the 50 States has a strong fish and game department or commission, and some of them, like

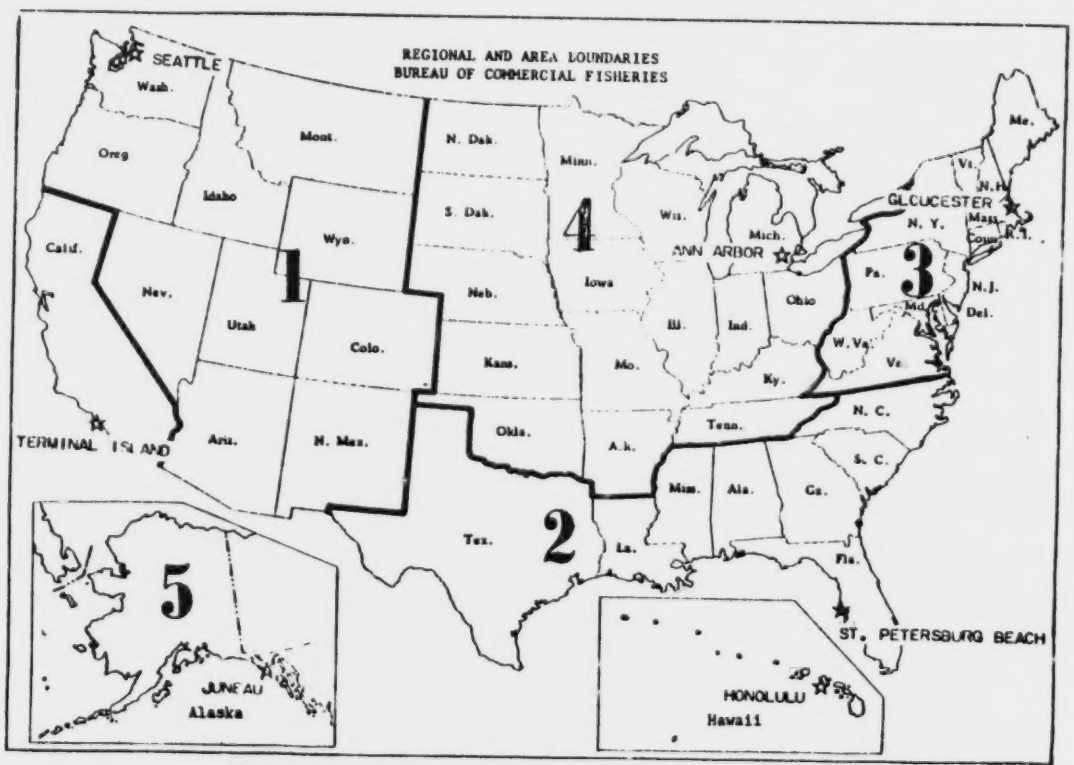
54875 O—60—3

Pennsylvania and several of the coastal States, have more than one agency engaged in this activity. These organizations have primary jurisdiction over fish and resident game, which constitute the bulk of the Nation's fish and wildlife resources. It is they who regulate the harvest of these resources and carry out other management practices.

The commercial fishery resources and the sport fishery and wildlife resources of the Nation, as stated, have importance to the economy and way of life of America in both the present and the future generations. There can be no question that provision of adequate water to maintain these resources is a vital necessity for the country as a whole.







STARS INDICATE LOCATIONS OF REGIONAL OR AREA HEADQUARTERS

Chapter II. Fish and Wildlife in Relation to Water Resources

In the rush to build a bigger and faster America, the problems of providing adequate living space for fish and wildlife and adequate spaces to use and enjoy them are compounded. It is a fact of history that changes wrought by modern civilization on the lands and waters of the earth tend to crowd out the wild things of nature.

There were 132 million people in the conterminous United States in 1930; 151 million in 1950; and an estimated 180 million today. Our population is expected to pass 200 million in less than 10 years. In 1980, the estimated population will reach 244 million and by 2000 will exceed 329 million. These great increases, together with the expanded demands of a larger economy, result in tremendous competition for land and water resources and thus great pressure upon the maintenance of adequate living space for fish and wildlife.

GREATER DEMAND FOR FISH AND WILDLIFE

In the face of this pressure on living space, the people of America are demanding more and more production of fish and wildlife from the water and related land resources of the Nation.

Demand for commercial fishery products

There can be no doubt that the demand for fishery products will increase markedly over the next 40 years. Fish is not only one of the important basic protein foods, but also forms the basis for many luxury foods. New products, constantly being produced, are winning increasing favor with housewives.

A problem.—Certainly our total supply of protein food must keep pace with the growth of our populations. Moreover, we should think of a greater than proportionate increase if we are to help meet higher protein demands for our people and other peoples of the world. Whether the need is filled by fish, meat, cheese, eggs, or vegetable protein will be partially a natural outgrowth of our economic development, but will also be substantially affected by governmental decision. Such decisions are a matter of basic policy which will not be dealt with herein. We shall, rather, proceed with the working assumption that the increase in production of fishery products must keep pace with the increase in population—and this will be a challenging job.

"Food," the Yearbook of Agriculture, 1959, poses this question on the subject of feeding our people:

> The gigantic task of feeding today's population or the larger population likely in 50 or 100 years is hard indeed to visualize, and we ask ourselves: How long will it be before a point is reached when increases in food production cannot keep up with increases in population?

We should somehow increase our total production of fishery products by 5 billion pounds over the next 40 years if we are to keep pace with population growth. Assuming that the present balance of production of fresh-water and marine species is maintained, this would mean about 3 billion pounds more of fresh-water-dependent species.

Based on the present rate of fishery development, however, our most hopeful estimates for total U.S. production in 2000 amount to an increase of about 2 billion pounds of fresh-water-dependent fish or only 70 percent over the 1954 base. (See tables 4 to 6.) To achieve even this much with today's methods, we would need additional water supplies, and still could expect to fall short of the required amount by 1 billion pounds of product. The need for improved production techniques is clear.

Possible solutions.—We must be concerned not only with the increased demand for water which may be required to increase production of food fish but also with a possible inadequacy of the increase fully to meet anticipated needs. The solutions to these problems must come from either the development of superior methods of production to provide more pounds of product with the amount of water available, or the derivation of additional large quantities of fishery products from other sources. The problem will most likely be met with a combination of the two.

The high seas offer an obvious possibility for increased supplies of fishery products, but with our present knowledge we cannot increase their general productivity since the seas are hunted, not farmed. Nor can we fertilize, cultivate, or seed them to any significant degree. Even the ocean's resources are not unlimited, and the most desirable species are already being heavily fished, not only

off our coasts but throughout the world. Under aggressive expansion programs, many countries are even pressing close upon our shorelines in search of abundant marine species. Our most valuable stocks are presently under heavy exploitation and halibut, haddock, cod, salmon, and many other fishes appear to be at, or near, maximum yield throughout much of their range. More fishing may only reduce production of these species, as the dynamic balance of the populations becomes upset.

Underexploited oceanic fishes which will eventually be harvested will, for the most part, produce unfamiliar products requiring intensive product development and promotional efforts to find ready sale on the U.S. market. The development of new or improved techniques of preparation, packaging, and distribution of fishery products could increase demand and permit higher production from our underutilized ocean fishery resources.

The costs of manpower, production goods, and operations are so high in the United States that, with present methods of fishing, we could not think of sending a great fleet of vessels to range the oceans in competition with the Japanese and Russians, or South American and European countries. However, the development of new or improved methods for harvesting fish might increase the efficiency of our vessels sufficiently to allow them to operate economically in the high-seas fisheries.

At all events, no increase in exploitation of the ocean commensurate with our increasing population appears possible without great technological advances. Could we more easily rely upon imported commodities to make up the difference? We have been doing this lately at an unprecedented rate, but it appears unlikely, in the face of rapidly growing world demand, that we can continue to depend upon imports. Near-capacity yield of the most sought-after species will probably be reached in the next decade or so, to be followed by serious world shortages and increased demand for products of foreign producers at home and in other countries. It is likely that the United States would still receive sufficient supplies of luxury seafood items, but not of reasonably priced staples, which will be in great demand.

One of our greatest hopes is the development of cultivation methods, both in inland ponds and in the brackish estuaries along our coasts, where we can fertilize and seed our aquatic fields, and husband our stocks. The productivity of properly balanced cultivating systems is tremendous in relation to the amounts of water required. Fish-farming methods are presently in use throughout many other parts of the world and have only recently been given attention in the United States. Fish farming in the ponds and estuaries will exert a demand upon fresh-water resources, not for greatly increased volumes perhaps, but for well-regulated supplies of good quality. This matter must be given a great deal of attention, since fish farming offers great possibilities for increasing production of desirable fishery products with minimum water and is highly susceptible to controlled operation and to technological advance. In thus directing our attention we must not neglect the urgency of maintaining and, where possible, improving the capacity of our waters for the support of the wild populations which now supply most of our 3 billion pounds of annual commercial harvest of fresh-water-dependent species.

The sport fishery of the Nation also contributes significantly to our food supply. For 1959, it is estimated by the Sport Fishing Institute that the sport catch totaled about 1.2 billion pounds, with about 858 million pounds from fresh water and 319 million from marine waters.

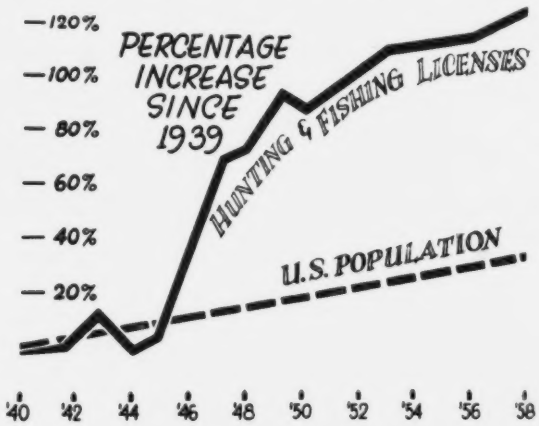
In summary, it appears that a shortage of fishery products may develop by 1980, which could most certainly become serious by 2000, unless definite precautionary measures are taken. The most hopeful solutions appear to lie in technological advances of the kind that require long-range research effort. If appropriate research programs are instituted within the next few years, solutions could be developed before the situation reaches a critical point.

Recreational demand for fish and wildlife

The recreational demand for fish and wildlife is spiraling upward at a tremendous rate. A recent issue of Life magazine (December 28, 1959), devoted to recreation and use of leisure time, aptly described the current demand for water-based recreation as a kind of "aquamania."

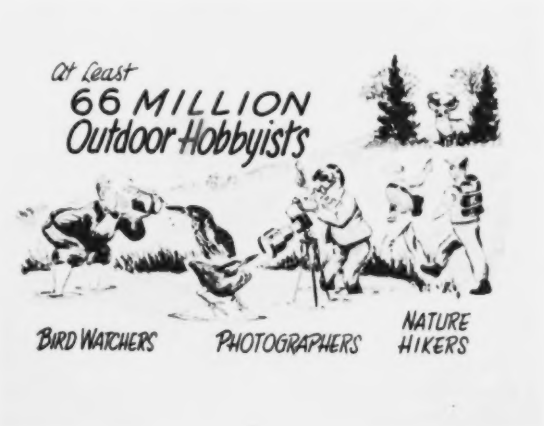
It was brought out that expenditures by Americans for leisure type activities has now reached an amazing $40 billion a year, or somewhat more than *8 percent of the gross national product*. Much of this is based on the availability of water resources for recreation which, in turn, depends largely on

opportunities for fishing and, to a lesser degree, hunting. *The Outboard Boating Club of America* reports that the recreational boating business approximated $2½ billion in 1959. It has grown to this size from a level of one-fourth of that amount in 1951. Somewhat more than half of the reasons given for boat purchases is that the new owners want to use them for fishing and/or hunting. If the initial purchase is not for the purpose of fishing or hunting, it seems certain that most boatowners eventually use their craft for one of these purposes. Thus, each activity is stimulated by the other.



At least half of the motivation for the fabulous boat sales of the Nation stems from the desire to go fishing.

It has already been noted here that in 1955 there were 25 million fishermen and hunters over the age of 11 who spent $3 billion in pursuit of their sports; they traveled 10.4 billion miles in their automobiles for fishing and hunting. The importance of fishing to the economy of a State



Hunting and fishing are not the only outdoor recreational uses of fish and wildlife.

is suggested by the report that Florida's deep sea fishing industry, including recreational, is nearly as large as her citrus and cattle industries combined. As much money, it is said, is spent on dogs as is spent on legal services by the people of the Nation.

The numbers of fishermen and hunters in the Nation are increasing at a rate far faster than the population. As shown in the table next following total sales of both fishing and hunting licenses between 1948 and 1958 increased at nearly twice the percentage of the population increase:

[Numbers in thousands]

Period	End-of-year population	License sales		
		Fishing	Hunting	Total
Fiscal year:				
1948	146,631	14,078	11,392	25,470
1958	174,054	20,178	14,764	34,942
Percent increase	18.7	43.3	29.6	37.2

THE BASIC PROBLEM

The basic problem is that the demand for adequate opportunities to enjoy and consume fish and wildlife resources is growing at a rate far faster than the population increase itself. At the very same time, the natural water and related land habitat of fish and wildlife is being destroyed or altered at a fast rate by the expanding population and economy.

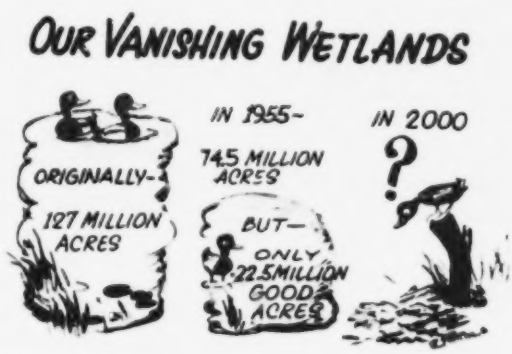
Effects of land-use programs

One aspect of this problem is the increased use of land for residential purposes. Each year since 1949 somewhat more than a million nonfarm dwelling units have been constructed. A large proportion of these new housing developments is being built in spreading suburbs near the larger cities. Until 15 years ago, most of these areas were composed of forests and open lands which provided living space for wildlife and hunting areas for the public. Streams in these areas formerly provided habitat for game fish and opportunities for public fishing. Now all of these values in the affected areas are gone or going under the wheels and blades of construction equipment.

Sprawling new industries have taken over fish and wildlife habitat at a tremendous rate since the end of World War II. The cost of new industrial construction exceeded $3 billion in 1956 and went to $3.6 billion in 1957, and $2.4 billion in 1958. Many of the sites for new industries are along the shores of rivers where there is a dependable water supply and, in many cases, access to low-cost water transportation. Hundreds of these sites were riverside marshes and wetlands utilized by waterfowl and other wildlife and as fish nursery areas prior to being converted into factories. The waste from industry and from the larger urban complexes, which is passed into the rivers in increasing quantity, pollutes streams and bays and destroys or detracts from their usefulness as fish and wildlife habitat.

The wetlands of the Nation, acre for acre the most productive fish and wildlife habitat, are disappearing at an alarming rate. The white man found 127 million acres of these marshes, swamps, and overflow lands when he arrived on these shores. Today, only about 74.5 million acres remain in the conterminous United States—a 41-percent reduction. The marshes and other wetlands have been filled to provide areas for the expansion of municipalities or industry, or to improve transportation. They have also been drained to provide additional land for agricultural production; much of this agricultural drainage has been accomplished with the technical and financial assistance of the Federal Government. About one-half of the vital waterfowl production habitat in the northern prairie States has been destroyed forever by draglines and the ditches of the drainage program.

There are problems for fish and wildlife resulting from construction of highways. The tremendous rights-of-way needed for intercity automobile routes remove very large acreages of land which would otherwise be available for many other uses. Vast areas of good wildlife habitat are falling before the bulldozer, the grader, and the paver. Marshlands and other wetlands are particularly vulnerable to construction in the highway program because they are, in many cases, the cheapest right-of-way.



Wetlands are, acre for acre, our most productive fish and wildlife habitat, but they are being destroyed like the pine forests along our northern boundary were destroyed two generations or more ago.

Farm drainage in the northern prairie States is gutting duck habitat in this major waterfowl producing region.

Effects of water resources programs

The huge water resources program of the Federal Government has an altogether vital effect on fish and wildlife resources. Thousands of projects impounding water to be used for irrigation, hydroelectric power, or flood control have been built in the United States by the Federal Government, under Federal license, or with Federal technical and financial assistance. Hundreds of other projects have involved the dredging of streams, estuaries, and inshore waters to provide for navigation and flood control. Across the land, water is removed from its natural courses by thousands of pumps and diversions to provide for the needs of cities and towns, agriculture, and industry.

These water programs can be a threat to the very existence of the fish and wildlife resources of this Nation unless there is adequate consideration of these resources. Every mouthful of a clamshell bucket or a dragline scoop dug from the bottom of a stream or estuary may take away a piece of living space for a fishery resource and have other effects besides. Every time a control gate in a dam is closed or opened, the characteristics of the stream below it and the impoundment above are changed, thereby changing the habitat of fish and wildlife utilizing the stream and impounded waters. Meandering rivers which have offered outstanding opportunities for fishing and as resting areas for waterfowl are many times converted into straight, swift-flowing, denuded water courses of little value to fish and wildlife. This has happened particularly in some parts of the lower Mississippi River Basin.

Dams may block the passage of fish that live most of their lives in the sea and run into fresh water high in the headwaters of the rivers to spawn and reproduce their kind. If this happens, the life cycle is broken and the run of fish may be destroyed. This has happened to the Atlantic salmon runs in most rivers in New England.

The estuaries of our gulf and Atlantic coasts are essential production areas for shrimp, oysters, and other shellfish and are nursery grounds for marine fin fishes which support both commercial and sport fisheries. In addition, these estuaries and associated marsh and wetlands are essential parts of the waterfowl habitat of the Nation. In recent years, particularly, many estuaries of the Nation have been subject to dredging and spoil deposition in a manner which has played havoc with their important fish and wildlife resources. Dredging for deeper navigation channels and filling for new land areas for both industrial and residential use have spelled the doom of many estuarine fish and wildlife areas.

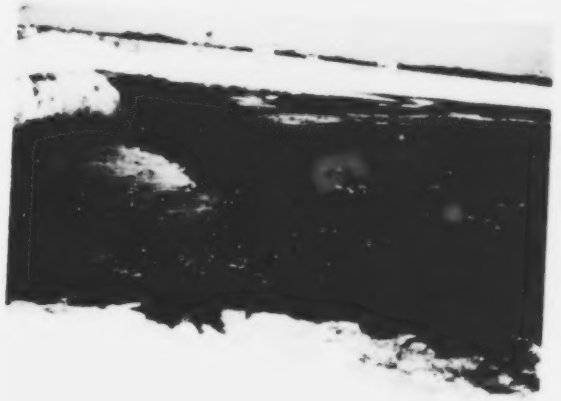
There is growing concern among conservationists generally and especially among those interested in wildlife and in recreational and commercial fishing over the intensive and widespread development of the Nation's estuaries, along its coastlines.

> There are long stretches of coast about the world where land and sea are not so sharply distinct as they are at rocky shores; where instead, the two merge gradually in an irregular and sometimes intricate edging of estuaries, sloughs, lagoons, and mudflats, brackish swamps, and fringing islands. This transitional area where the land reaches out into the sea and the sea into the land is one of the most interesting of all marine ecosystems, and perhaps from a fishery viewpoint potentially the most valuable. In some places it is richer than the richest farm country, for it is lavishly fertilized with inorganic nutrients which the land is continually pouring into it.

Thus Walford describes in "Living Resources of the Sea" (The Ronald Press, New York, 1958) the whole complex of environments called estuaries, which play a crucial role in the lives of species making up at least 60 percent of our total catch of sport and commercial fish. Here are the living areas for tremendously productive populations of oysters, clams, and crabs; and the nursery grounds, so vital to various species of shrimp, our most valuable commercial fishery resource, and to menhaden, our most valuable single species. Through these waters pass many species on annual sojourns for feeding or spawning or for returning to their native streams to spawn. Walford continues:

> Thus the brackish area is not only the home of its own fauna of year-round permanent residents, but is also a spawning ground for some species that come in seasonally, a nursery for others that drift in during planktonic stages, an occasional feeding ground for others that wander in and out at random, and a thoroughfare for still others that are migrating between river and sea destinations. With all this flow of life, the biological content of the brackish area is extraordinarily rich. And, being conveniently close to land, shallow, and well protected from the open sea, it is the most likely part of the sea subject to cultivation.

As we have become increasingly aware of the crucial role played by the estuaries, so have we become increasingly concerned over their future. Each section of coastline has specific problems in connection with its estuarine areas. Among these



The death of an estuary: discharge from a dredge.

The coastal marshes and estuaries, which are important to many commercial species of fish as breeding and nursery grounds and to waterfowl as wintering areas, are destroyed by drainage. Urban encroachment into such areas is also destructive.

are: filling of marshland areas in New England, domestic and industrial pollution in the Middle Atlantic, pesticide pollution in the South Atlantic, leveeing and similar development in the eastern Gulf of Mexico, water supply shortage in the western gulf, and pulpmill pollution in the Northwest. The growing concern is clearly illustrated by the following statement from the September 1958 supplement to the 16th Annual Report of the Atlantic States Marine Fisheries Commission:

> As our knowledge of the biology of our major commercial and sport fishery resources grows, we are becoming more and more impressed with the significance of estuaries and inshore waters, from Maine to Florida, as breeding and nursery grounds for many of the most important species. Whether your chief interest lies in the North, Middle, or South Atlantic region, the condition of the fishery resources is to a large degree dependent upon the condition of these waters.
>
> Unfortunately, these waters, because they are close to centers of population and industrial development, are particularly vulnerable to effects of human activity, and the rapid growth of population and tremendous industrial expansion of recent years are raising serious problems that may have far more fundamental effects upon the fisheries than any effects produced by fishing activities themselves.
>
> Perhaps the most serious effects of human activity, though they are not obvious at first glance, are changes produced by alteration of marshlands, for example, drainage and real estate development, deposition of spoil from channel dredging, deepening and widening of existing channels, construction of dams and other engineering works, diversion of river runoff for domestic and industrial wastes, which in their most obvious manifestations kill fish and other animals, but which may also have much more subtle and hidden effects upon growth, feeding, spawning, and other activities of marine life.
>
> If the question were simply one of protecting marine life, the solution might be relatively simple. It is complicated, however, by the rapidly expanding technological development of our civilization * * *.

Maintenance of channels for navigation is a recognized necessity but before new channels are opened or old ones reworked, the relationship and probable effects on fish, waterfowl, and other wildlife resources should be understood, so that proper safeguards can be included in the project to protect important fish production areas.

Level ditching of marshlands can be beneficial to fish and aquatic birds and mammals, if permanent waters are thereby provided. However, if drainage is complete, it prevents use of shallow water areas and habitats which are sought by many species. Careful planning and an understanding of the relationship between water and fish and wildlife should accompany the planning of all ditching projects.

Management of water levels along the coast can be very complicated and have effects that are not readily observed. There is generally believed to be an exchange of nutrients in tidal areas, that brings fertility to waters of the bays and sounds. To what degree this exchange occurs or is needed is not easily determined, yet the relationship is an important one.

It appears then that such water resource problems as may be associated with estuaries will not arise from possible shortages in volume but rather from the way in which the water is managed.

54875 O—60——4

Consequently, our efforts must be directed toward improving and stabilizing flow characteristics and quality of the supply. This is particularly important in relation to the tremendous productivity potential of estuaries under controlled culture practices, upon which we may be forced to rely heavily in the future.

THE BASIC SOLUTION

The expansion and growth of the economy and population will inevitably move the advancement of civilization farther into the natural domain of fish, shellfish, and wildlife. However, this does not necessarily have to be catastrophic to these living resources. It need not be if there is genuine recognition of the need for providing fish and wildlife a reasonable share of water and related land resources, even though they are developed primarily for other purposes. On the contrary, there are many phases of water-development programs which can be highly beneficial to fish and wildlife if appropriate measures for their conservation are incorporated in water-development planning.

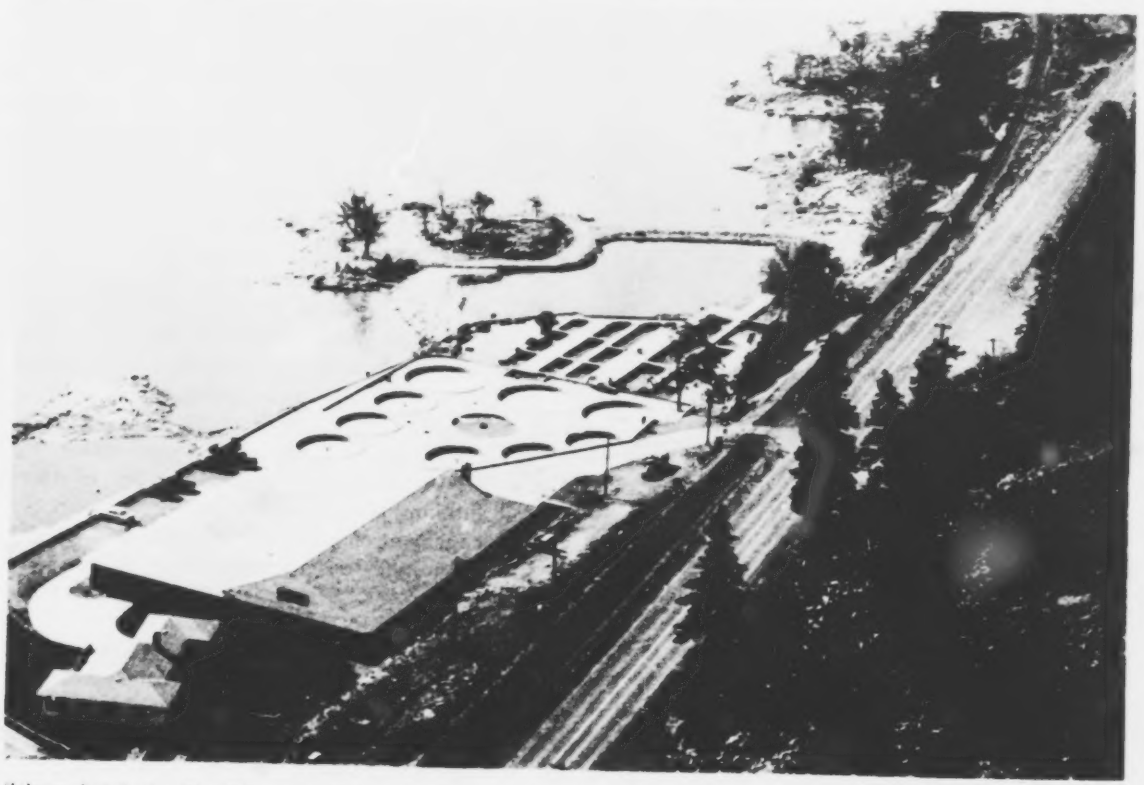
Much has been accomplished for fish and wildlife by the Federal and State agencies which have responsibility for conservation and management of these resources. The 101 Federal fish hatcheries, for example, distribute over 2 million pounds of fish annually to be released in lakes and streams. Distribution by species in 1958 is shown below:

Summary of fish distribution, by species, from hatcheries of the Bureau of Sport Fisheries and Wildlife, 1958

Species:	*Total weight (pounds)*
Warm water [1]	113, 611
Trout, grayling	1, 460, 602
Salmon	600, 260
Total	2, 174, 473

[1] I.e., Bass, catfish, pike, etc.

Source: Branch of Fish Hatcheries, Bureau of Sport Fisheries and Wildlife



Salmon hatcheries like this one at Spring Creek, Wash., on the Columbia River have been constructed in an attempt to maintain the salmon run for commercial and sport fishing use in the face of the building of dams along that great river.

Spawn is being taken from this salmon hatchery at Spring Creek, Wash.

In addition the 482 State hatcheries supply an estimated 13 million pounds of fish for this purpose annually.

To benefit the wildlife resources of the Nation, the Federal Government has established a national wildlife refuge system of 274 units comprising a total of nearly 18 million acres. Here, too, the States have a substantial program.

However, these installations, important though they are, cannot maintain the fish and wildlife resources of the Nation by themselves. It is not possible or feasible to assign the entire responsibility for fish and wildlife conservation of this Nation to the refuges, the fish hatcheries, and the wildlife management agencies of the State and Federal Government and to assume that it has been adequately taken care of. These facilities can represent at best only the nuclei for the fish and wildlife conservation needs of the Nation.

What is needed—and what is a must—is for the Congress, the State legislatures, and the agencies and organizations of the country which deal with land and water resources to give genuine recognition to the needs of fish and wildlife in the planning and construction of their facilities and programs.

This means that project units in the water resources program cannot and should not be built on the basis of plans designed solely to serve the interests of navigation, irrigation, flood control, and hydroelectric power in the most effective,

National wildlife refuges like Bear River in Utah help preserve essential waterfowl habitat, but they cannot do the job by themselves. Water and related land policies of the Federal Government must be conditioned for fish and wildlife if these resources are to survive.

efficient, and least costly manner for those purposes alone. It may be necessary to forego or modify the ideal development for these purposes, considered singly, in order to preserve and enhance the living natural resources and their associated recreational and commercial values. These should no longer be dismissed or brushed aside with only token consideration in the name of progress.

It must also be recognized that fish and wildlife conservation in water resources development cannot be accomplished free or even cheaply.

Substantial sums, though moderate in comparison to other project costs, must be devoted to conserving and developing fish and wildlife resources in water control projects.

Much has already been accomplished in the establishment of Federal policies and programs designed to provide for the conservation of fish and wildlife resources in the Nation's water resources program. The first step toward this objective was taken with the passage of the original Wildlife Coordination Act of March 10, 1934. This act authorized general investigations and assistance by appropriate Federal agencies in the fish and wildlife field. It made provision for the use of water impounded by the Federal Government for fish hatcheries and migratory bird areas. The act was amended in its entirety by the act of August 14, 1946 (60 Stat. 1080), and the first four sections were again amended by the act of August 12, 1958. The last amendment gave it the statutory title of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). A copy of the Fish and Wildlife Coordination Act as it now stands is included in the appendix.

This act, while it contains important authorizations for both Federal and State fish and game agencies for investigation and participation in planning, development, and operation of water resource projects, is perhaps most significant in its provision of authority for Federal construction agencies to incorporate fish and wildlife conservation and enhancement features into project planning.

Basically, the act provides for a study by the Fish and Wildlife Service and the affected State fish and game agencies of all Federal construction projects, and those requiring a Federal license or permit, involving the use and control of water. The purpose of the study is (1) to determine the effects of the project on fish and wildlife resources, and (2) to formulate measures for incorporation in project construction and operation plans designed to eliminate or mitigate adverse effects on those resources and to take advantage of project-occasioned opportunities to develop and enhance fish and game.

The act also provides authority for Federal construction agencies to modify their plans for project construction and operation to accommodate these measures, and to acquire additional project lands for fish and wildlife conservation purposes.

These activities also are carried on in connection with projects licensed by the Federal Power Commission. In accordance with the Fish and Wildlife Coordination Act and the Federal Power Act (especially sec. 18 thereof),[2] the Secretary of the Interior requests the Commission to include conditions in licenses requiring modification of project construction and operation plans in the interest of fish and wildlife conservation. These recommendations are based on surveys made by the Fish and Wildlife Service, in cooperation with the State fish and game agencies, following referral of license applications to the Secretary by the Commission for review and comment.

Similar activities are carried on by the Fish and Wildlife Service pursuant to the Watershed Protection and Flood Prevention Act (68 Stat. 666, as amended), a copy of which is also included in the appendix of this report. This act provides, in section 12, for investigations of projects in the small watershed program of the Department of Agriculture by the Fish and Wildlife Service for purposes similar to those of investigations under the Fish and Wildlife Coordination Act. Section 4 of this act provides that the Secretary of Agriculture may pay from Federal funds part of the cost of incorporating fish and wildlife facilities in these locally sponsored projects.

IMPACT OF WATER-USE PROJECTS ON FISH AND WILDLIFE RESOURCES

As part of its organization, the U.S. Fish and Wildlife Service has a staff of specialists in surveys of water-use projects of other agencies to carry out the functions prescribed by the Fish and Wildlife Coordination Act. Close cooperation is maintained continually in this work with the State Fish and game agencies and the water resources planning and construction agencies.

Biological, economic, and engineering surveys by the staff of the Fish and Wildlife Service are designed to determine the impact of a water-use project on fish and wildlife resources and to

[2] Pertinent excerpts from sec. 18 of the Federal Power Act (16 U.S.C. 811) are as follows:

"SEC. 18. The Commission shall require the construction, maintenance, and operation by a licensee at its own expense of such * * * fishways as may be prescribed by the Secretary of Commerce * * *." (This function was transferred to the Secretary of the Interior by Reorganization Plan No. II of July 1, 1939 (53 Stat. 1431, 1433).)

develop means and measures for incorporation in the project plan for the conservation and enhancement of these resources. The objective here is not simply to develop data on the biological effects of an already-crystallized project plan. Rather, it is to formulate modifications during project planning which will enable the project to serve a fish and wildlife conservation function as well as other water control functions. (These functions are by no means incompatible.)

The results of these surveys are presented by the Fish and Wildlife Service in reports which are required by law to accompany reports prepared by the project construction agencies when they are presented to the Congress or others for authorization. Somewhat more than 3,000 of these reports have been prepared since the function was established in 1946. Hundreds of projects in all parts of the Nation are now providing benefits for fish and wildlife conservation as a result of these activities. The legislative authorization for many projects of the Corps of Engineers and the Bureau of Reclamation includes specific provisions for fish and wildlife conservation.

The following pages describe generally the fish and wildlife problems caused by various types of water projects and water-related problems and the approach taken by fish and wildlife conservation agencies in attempting to solve these problems.

Dam and reservoir construction

The construction of dams and reservoirs normally has many and diverse effects on fish and wildlife resources. These effects are dependent

The Sacramento River in California continues as an important salmon producing stream despite Shasta Dam, shown above, because adequate provision was made for measures to compensate for the potential destruction of the run. (Bureau of Reclamation photograph.)

upon many factors, including the region of the country in which a reservoir is to be constructed, the climate, the topography, the size of the reservoir, its depth, the fluctuation pattern, the flow remaining in the stream below the dam, the type of vegetation and topography inundated, and the purposes for which the reservoir is to be operated. These and other factors influence and dictate the effects upon fish and wildlife resources.

Effect on anadromous fish.—Dam and reservoir construction has adversely affected anadromous fish species through blocking their passage to and from the spawning grounds; decreasing the flow with resulting loss of living space, buildup of contaminants, and interference with migration; increasing the silt load of the rivers; physically damaging vital living and spawning areas; upsetting required oxygen and temperature conditions; and damaging the vegetative food base for the species.

New England provides a good example of the adverse effects of dam construction on anadromous fish stocks. Numerous streams were dammed, many before the American Revolution, to provide power for industrial and domestic purposes and no plans were made for the passage of fish to their spawning grounds. As a result, the Atlantic salmon runs disappeared altogether and shad and alewife runs declined to very low levels.

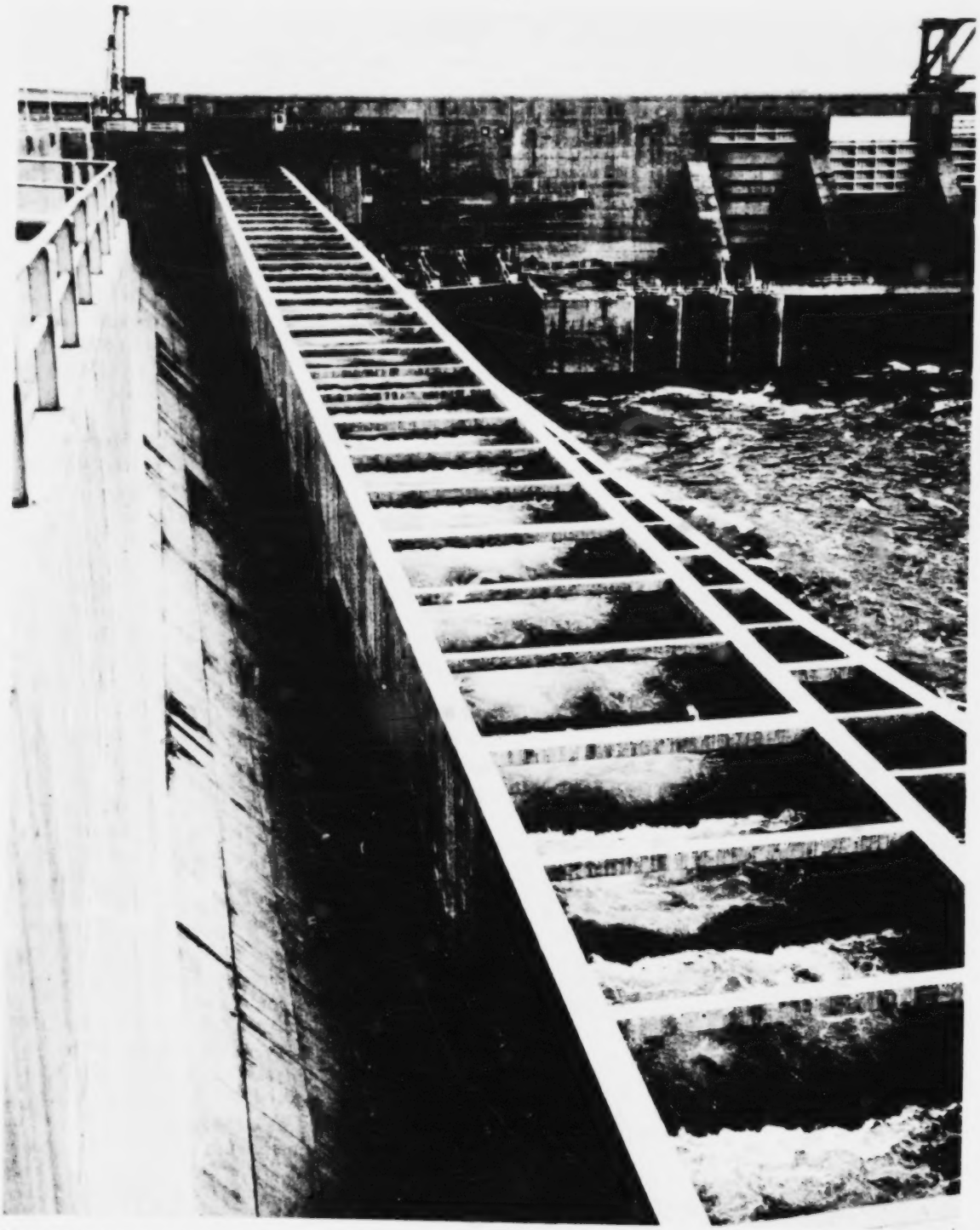
The great salmon fisheries of the Pacific coast have for years been threatened everywhere, except in Alaska, by competition from many types of water usage programs. Even Alaskan rivers may be affected in the future by large-scale development projects now being programed.

The tremendous economic development of the Pacific Northwest, which will probably continue at a rapid pace throughout many future decades poses unusually difficult problems for the use of fresh waters for fish production in the future. The river problems do not stem from shortage of water supply but rather from methods of usage. Industrial water use may result in the loss of some streams tributary to large rivers which now produce significant numbers of anadromous salmon and steelhead. Future irrigation developments in some of the subbasins will no doubt seriously reduce the productive capacity of many fine salmon streams. The major conflict of interest in future water use rests, however, between hydroelectric power and salmon and steelhead trout interests. Much of the present fishery values of the Columbia River system may be lost unless a means can be found for combining high dams (creating large manmade lakes) with satisfactory conditions for production of salmon and steelhead.

Since California is the southern limit of the salmons' range, the species here are in delicate balance with their environment. Decreases in salmon populations are directly related to decreases in water supply, since low levels of flow reduce available spawning area and actually expose the nests and developing eggs in the shallow gravel spawning beds. Increased stability and total volume of flow must be planned if provision is to be made for increased catches of salmon.

Effect on wildlife.—Reservoirs commonly inundate wildlife habitat, thus either destroying animals themselves or forcing them into adjacent habitat which commonly is already supporting wildlife to the extent of its capabilities. In many parts of the arid West, the only habitat suitable for many species of wildlife occurs in the river bottoms. Inundation of such habitat by a reservoir or by a series of reservoirs, such as those on the Missouri River in the Dakotas or the Colorado River in the West, may also completely eliminate an essential type of habitat for various species of wildlife, such as winter range for big game. Also habitat for pheasants and other upland game may be destroyed. Waterfowl which frequently concentrate on impoundments may cause depredations on surrounding croplands. In some areas, the construction of reservoirs blocks the ancestral migration routes of big-game animals, cutting them off from their wintering grounds or subjecting many of them to death by starvation or by drowning when they attempt to cross the reservoir on thin ice.

Other effects of reservoirs.—Insufficient releases of water from the dams to the streams below at appropriate times of the year result, in many cases, in fishery losses. Reservoirs inundate important spawning areas for fishes, especially anadromous species, and in other cases reservoirs in northern latitudes may not have sufficient depth to permit year-round fish life. Fish eggs may be stranded by reservoir drawdown during critical seasons. Stream temperatures below dams in many cases are altered due to the temperature of water released from the reservoirs, thus destroying valuable existing fisheries.



This fish ladder at McNary Dam on the Columbia River, Wash. and Oreg., was constructed for the passage of salmon and steelhead over the 78-foot dam to spawning grounds upstream. (Corps of Engineers photograph.)

On the other hand, benefits may accrue to fish and wildlife resources as a result of reservoir construction. Foremost among these benefits are the tremendous expansion of fishing opportunities which these reservoirs afford. Normally, they multiply manyfold the fishery resources and fishery opportunity present in streams inundated. The use of reservoirs for fishing and related types of outdoor recreation is growing at an almost fantastic rate. According to the Corps of Engineers, there were 16 million visitors to its reservoirs in 1950. By 1959, the number had increased nearly sevenfold to a total of 106 million. While it is true that all of these visitors are not fishermen, it is clear that fishing opportunities represent the big drawing card.

At the same time, the lake-type fisheries provided by reservoirs prove to be less desirable to some fishermen than the stream fishery inundated. Also oxygen deficiencies which arise in some reservoirs, particularly deep ones, create problems for maintenance of fisheries in streams below the dams. Despite this, splendid tailwater fisheries are, in some cases, characteristic of waters of rivers immediately downstream from reservoirs. Moreover, water releases from reservoirs, when controlled in volume, temperature, and quality with a view toward maintenance of the fishery in the stream below result in substantial improvements of that fishery over natural conditions.

Waterfowl and aquatic fur animal use of project areas may be increased, and in some cases excellent opportunities exist for the establishment of Federal or State wildlife refuges. On the other hand, creation of new water areas may change the distribution of waterfowl and their harvest. It may also change the pattern of depredations as related to agricultural crops in the vicinity of the reservoir.

Many different recommendations may be made to fit specific conditions in reservoir projects. These include such measures as minimum flows of water below dams, minimum pools in reservoirs, acquisition and development of land for wildlife management, selective clearing of timber, schedules for water-level manipulation, construction of fish hatcheries, provision of fish-passage facilities, and construction of low-level outlets to discharge cool water into streams.

Example: Middle Snake River Dams, Idaho-Oreg.—Some of the most serious problems brought about by reservoir construction are being experienced in connection with the construction of reservoirs on the middle Snake River in Oregon and Idaho. On August 4, 1955, the Federal Power Commission issued a license to the Idaho Power Co. to construct the Brownlee, Oxbow, and low Hells Canyon Reservoirs. The plan for the Brownlee development consisted of a dam having a maximum head of 277 feet at river mile 287; the Oxbow Dam, 117 feet at river mile 272; and the low Hells Canyon Dam, 208 feet at river mile 247.

It was recognized that these dams would block the migration runs of extremely valuable salmon and steelhead trout ascending to their spawning grounds in the middle and upper Snake River and its tributaries. As a result of representations by the Department of the Interior, based on studies by the Fish and Wildlife Service, and the State fish and game departments, the license issued to the Idaho Power Co. provided that: (1) the licensee was to make available to the Secretary of the Interior up to $250,000 for use by the Fish and Wildlife Service in studying the fishery and devising means and measures for mitigating losses to that resource; (2) the licensee was to construct, maintain, and operate, or arrange therefor, such fish ladders, traps, or other fishery facilities as might be prescribed by the Federal Power Commission upon its own motion or upon the recommendations of the Secretary of the Interior and the conservation agencies of Idaho and Oregon; (3) the licensee was to negotiate with the Department of Fisheries and the Game Commission of the State of Oregon, and the Department of Fish and Game of the State of Idaho with respect to the amou ' the licensee should pay each year to defray a reasonable portion of the operation and maintenance cost of fishery facilities; and (4) the licensee was to negotiate with the two States fish and game agencies with respect to the acquisition by the licensee for the State agencies of island and marsh areas along the Snake River for development as substitutes for waterfowl nesting areas to be lost by reservoir inundation.

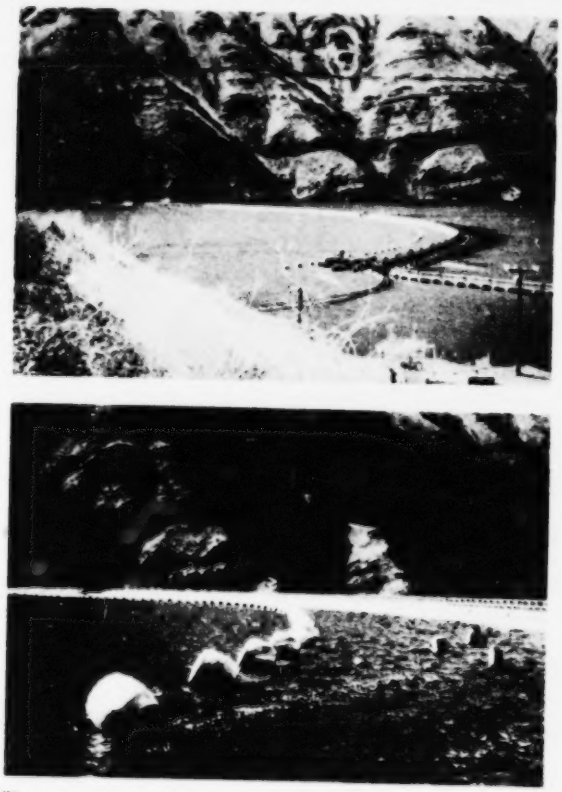
Following the issuance of the license, the Fish and Wildlife Service and the Oregon, Idaho, and Washington fish and game agencies carried out detailed studies and extensive negotiations with the Idaho Power Co. As a result of these studies and negotiations certain recommendations were made by the Department of the Interior and the State fish and wildlife agencies to the Federal Power Commission. The Commission, acting on these recommendations, issued an order on February 12, 1958, prescribing fish .acilities. That order stipulated that the Idaho Power Co. was to construct,

This is an example of an excellent tailwater fishery, just below Enfield Dam on the Connecticut River in Connecticut. These men are fishing for shad. (Photograph courtesy of George Heinold and Outdoor Life Magazine.)

54875 O—60——5

operate, and maintain a forebay net barrier with fish skimming and trapping devices at Brownlee Dam for downstream migrants, upstream facilities at the Oxbow powerhouse and spillway, and facilities for transfer of anadromous fish runs from the tributary Wild Horse River which flows into the Oxbow pool. The Brownlee and Oxbow Dams are now under construction, and the fishery facilities at these reservoirs are still under construction.

Much work and negotiations remain to be undertaken in connection with the anticipated construction of the low Hells Canyon Dam. There are spawning streams entering the Snake River between Oxbow Dam and the Hells Canyon Dam site which will be blocked by the construction of the latter dam. An issue to be decided is whether the Hells Canyon Dam is to be laddered and access to those spawning streams maintained, or whether, as is desired by the Idaho Power Co., upstream migrants may be collected below Hells Canyon Dam rather than below Oxbow Dam, as is now done, and hauled by truck to points above Brownlee Dam.



The net suspended from these floats in the forebay of Brownlee Reservoir on the middle Snake River, Oreg. and Idaho, is about 1 mile upstream from the dam and extends to a depth of 120 feet. Young salmon and steelhead are screened away from the power tube intakes and into trapping devices for safe transfer downstream.

This discussion of the problems created by construction of these dams on the Middle Snake River has been presented only in barest outline. The problems involved are exceedingly complex, and extensive studies and negotiations are required to arrive at satisfactory solutions. It can be seen, however, that very close coordination among all agencies involved in the planning, construction, and operation of such projects is required so that fish and wildlife resources may be preserved.

Channelization .

The channelization of rivers and streams and the construction of new channels through land or marsh areas are of great concern to the fish and wildlife interests.

There are numerous projects throughout the country which involve the deepening and straightening of streams in order to reduce flooding, increase the rapidity of runoff, lower the water table on adjacent lands, and improve navigation. Such projects often destroy valuable fish habitat by dredging in the project area, increasing siltation in downstream areas, and decreasing or eliminating overflow on adjacent lands or areas which are used as spawning and nursery areas by fishes. Estuarine dredging is particularly destructive when it destroys or alters an existing ecological balance. (See discussion earlier in this chapter.)

Channelization projects may also harm wildlife resources by destruction of fur animal habitat, drainage or filling of adjacent marshlands, and the destruction of tree and shrub cover along the stream. Particularly in the South, a number of fish and wildlife species have evolved life processes which are adjusted to periodic seasonal flooding of lands along the streams. For example, numerous fishes, both game and commercial, spawn chiefly in overflow backwaters; millions of waterfowl winter in flooded hardwood bottoms. Profound changes in this environment result when such overflows are reduced or eliminated, whether by dams or by channelization.

Some projects involve the construction of new channels through uplands or marshes. These projects can cause serious detrimental effects on various forms of wildlife such as upland game and waterfowl. The channelization of existing streams rarely results in improved fish and wildlife habitat, though in some cases, if fish and wildlife measures

are incorporated in the construction and operation, substantial benefits may result.

There are a number of measures which can be included in specific channelization projects for the purpose of mitigating losses or improving habitat for fish and wildlife resources. Sometimes, channelization projects which involve straightening of streams may cut off sections of the streams. If these oxbows are plugged and water maintained in them, good fish and wildlife habitat often can be created. At other times it may be possible to realine waterways so that they avoid valuable marshes. It is standard practice for the Fish and Wildlife Service to recommend that the construction agency coordinate its plans for spoil disposal with the Federal and State conservation agencies so that existing marshlands can be protected and occasionally new marshes created. In some cases, it is deemed necessary to acquire lands for fish and wildlife purposes for habitat development to compensate for habitat destroyed by a project.

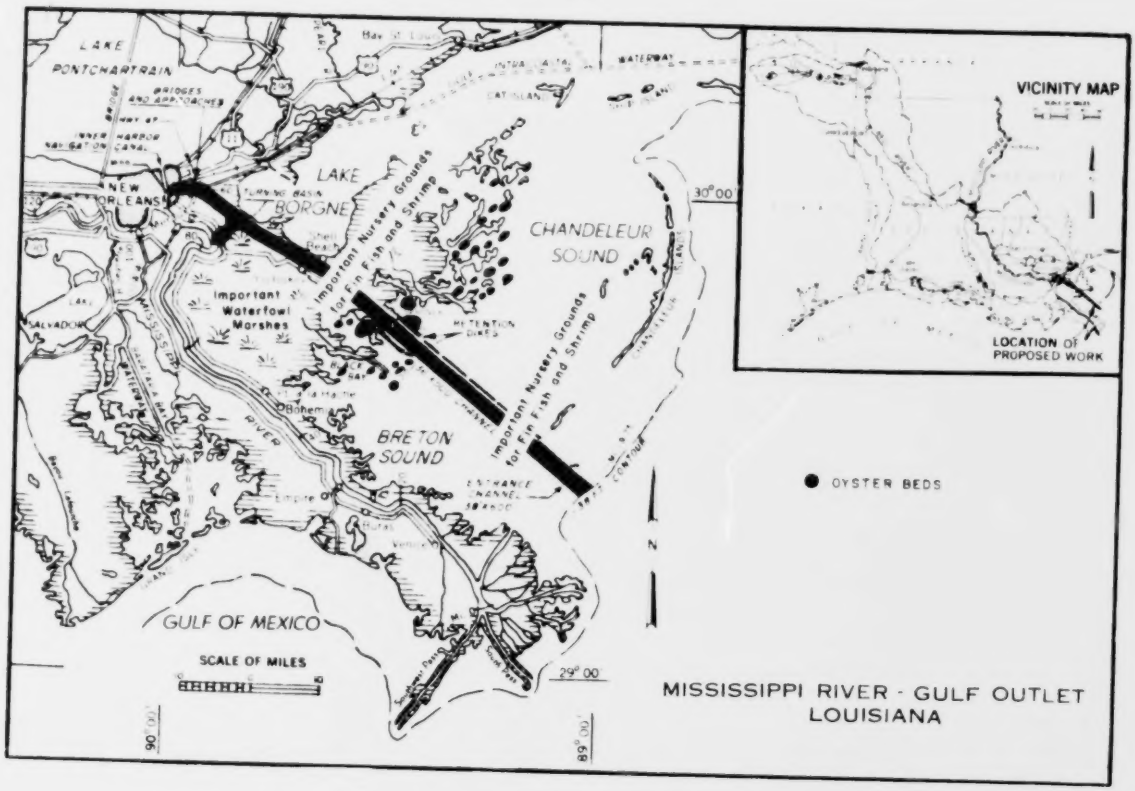
Example: Mississippi River-gulf outlet project, Louisiana.—The Mississippi River-gulf outlet project of the Corps of Engineers in Louisiana is an example of the construction of a ship channel through valuable estuarine-marshland environment. The plan of development provides for construction of a channel 36 feet deep and 500 feet wide extending from the New Orleans Harbor southeasterly to, and along the south shore of, Lake Borgne and through the marshes to and through Chandeleur Sound to deep water in the Gulf of Mexico, a distance of approximately 70 miles. Dikes and jetties also are included in the project plan. The plan was formulated in 1946, at about the time the Fish and Wildlife Coordination Act of August 14, 1946, was enacted, and no consideration was given to fish and wildlife resources. No action on the plan was taken until a bill to authorize the project was passed in the 84th Congress and signed by the President on March 29, 1956.

Throughout the length of our Atlantic and gulf coasts, dredges are busy chewing up essential fish and wildlife habitat.

These fine counter quality oysters have just been harvested from a Louisiana estuary. Silt from man's activities destroys oyster beds in estuaries.

Recent studies by the Fish and Wildlife Service have shown that the marsh and estuarine areas through which the channel is to be placed comprise extremely valuable habitat for sport and commercial fisheries, waterfowl, and fur animals. It was determined that the marsh area adjacent to Lake Borgne, an estuarine water body in the area, has greater value to fish and wildlife than has the lake itself. Consequently, the Secretary of the Interior recommended to the Department of the Army that the canal be realined through Lake Borgne in order to protect fish and wildlife resources. The Secretary of the Army did not accept that recommendation because of his finding that relatively high costs would be involved.

The Fish and Wildlife Service is continuing its investigations of the project area to determine



means and measures which can be taken to preserve as much fish and wildlife habitat as possible. A number of recommendations have been made on specific segments of the channelization project. These recommendations include the use of draglines rather than suction dredges in order to minimize dispersal of spoil materials, the placing of spoil in specific locations and enclosing such spoil with dikes, the location of borrow pits at specific sites, specific details on the construction of weirs, and other details of project construction and operation. Many of these recommendations have been accepted by the Corps of Engineers.

Channelization projects, as noted, have the potential for destroying extremely valuable fish and wildlife resources. The integration into project plans of specific measures for fish and wildlife conservation, however, can be of great assistance in preserving these resources.

Dredging and filling

Dredging and filling projects are closely allied to channelization projects which have already been discussed. As used in this report, dredging refers primarily to projects for the deepening and maintenance of navigation channels, and filling refers to deposition of spoil obtained from such projects.

The deepening of river channels may seriously disturb shellfisheries and may cause detrimental effects for long distances downstream due to the increased silt load carried in the stream. One of the most serious effects which results in many cases from dredging and filling projects is the destruction of valuable waterfowl marshes by the deposition of spoil.

Here again, this type of project may have a tremendously adverse effect on the fish and wildlife resources of our estuaries. One of the most apparent is the filling of estuaries and shallow waters to provide more land. This is going on at a rapid rate in many locations, to develop new industrial sites and new homesites. The coast of Florida, for example, is presently undergoing an extensive modification for the latter purpose. Water areas lost in this manner are not replaced.

Dredging of bottoms with the accompanying dumping of spoil is not as readily seen but is responsible for modifying large areas of bottoms.

Example: Delaware River channelization project, Pennsylvania-New Jersey.—The Delaware River channelization project of the Corps of Engineers calls for a channel 40 feet deep and 400 feet wide for a distance of 23½ miles between Philadelphia, Pa., and Trenton, N.J. Auxiliary channels and bank stabilization works also are a part of the project. The plan includes the removal of somewhat more than 42 million cubic yards of spoil from the channel, requiring spoil disposal areas with a combined capacity of 26,000 acre-feet. Most of the material is to be removed by hydraulic dredge and pumped into diked disposal sites, of which some 38 possible areas have been located.

The Fish and Wildlife Service studied the project plan and area in considerable detail and found that major losses from construction and maintenance of the project would be incurred by wildlife resources of the area, particularly waterfowl, shorebirds, and muskrats. Waterfowl resources of national significance would be lost if the project were built and operated as originally planned. The Service recommended that the Corps of Engineers include funds in its budget request for the project for the acquisition of key waterfowl areas as partial replacement of valuable waterfowl habitat to be lost. The Corps of Engineers did not accept this recommendation. However, after extensive negotiations, the corps has developed plans for disposal areas which would not conflict with the waterfowl needs to nearly so great an extent as the previous plan.

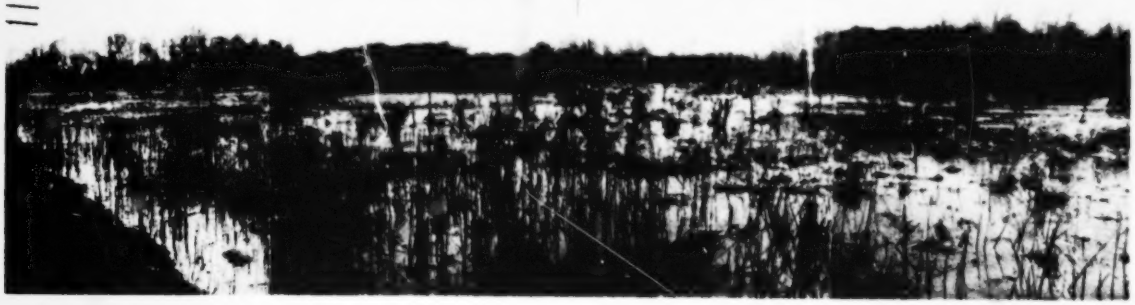
One of the greatest problems in connection with spoil disposal is that the Corps of Engineers maintains that disposal sites are to be furnished by local interests and that the corps, therefore, has no control over the location of such sites. In the Delaware case, however, the district engineer indicated his intention of furnishing copies of the spoil disposal map to the States of Delaware, Pennsylvania, and New Jersey to advise them of areas which would meet the Federal Government's needs with respect to navigation. It is hoped that close cooperation on this matter will result in the preservation of important wildlife habitat.

In past years there was some doubt that the act of August 14, 1946 (60 Stat. 1080), applied to navigation projects. The Fish and Wildlife Coordination Act as last revised on August 12, 1958, clearly applies to projects involving the deepening of channels and other control or modification of bodies of water for navigation purposes. Under this new provision fish and wildlife interests are hopeful that much needless destruction of fish and wildlife habitat can be averted.

Pollution and siltation

The maintenance of water quality is a critical problem facing the Fish and Wildlife Service. Commissioner Arnie J. Suomela recently stated—

> It is considered that the amount of fish and wildlife habitat rendered unproductive each year is greater than that created by public agencies in carrying out programs of fish and wildlife restoration. Indeed, it appears that the effect of pollution in depressing production and use by valuable fish and wildlife would be to nullify much of the inland fishery and wildlife conservation effort when this is viewed on the national scale.



This marsh area in New Jersey, which supports wildlife resources of national significance, is in danger of being lost because of proposed use as a spoil disposal area for the Delaware River channelization project, Pennsylvania-New Jersey.

Water-development projects may have either beneficial or detrimental effects on problems of pollution in the Nation's streams and lakes. Pollution in streams can be seriously detrimental to fish and wildlife resources through direct toxic effects and the reduction of the dissolved oxygen supply. Municipal and industrial wastes often have a strong deoxygenation effect on streams. There is, in many cases, insufficient oxygen remaining in the water to permit the survival of fish. Pollution of the Great Lakes and other lakes and reservoirs from domestic and industrial sources, not so important now, may become a serious problem in the future.

Already, water quality is definitely impaired by industrial and domestic pollution in certain limited areas adjacent to densely populated and highly industrialized centers of the Midwest, such as southern Lake Michigan, southern Green Bay, Saginaw Bay, Detroit River, western Lake Erie and extreme eastern Lake Erie, and by 1980 increases in population and industrial expansion can be expected to raise the pollution load and thus cause further decreases in water quality unless effective control measures are placed into effect. It is entirely possible that fish species now present will no longer be able to exist in certain areas such as Saginaw Bay and western Lake Erie. Whether species of fish are available which could live in this area under those conditions cannot be predicted on the basis of present knowledge.

Many important environmental areas may become uninhabitable and fish production will decline. This problem will require serious study and application of corrective measures where indicated.

Loss of habitat through pollution is probably the single biggest negative influence on estuarine life. Coastal waters are, in too many cases, the dumping ground for wastes which may come from considerable distances inland. We are learning that some of the toxic substances found in industrial wastes and in chemicals applied to crops, orchards, marshes, et cetera, are cumulative in effect and difficult to remove. Standards of water quality are being set by responsible agencies in some States for many streams and public water areas, recognizing that conditions above the minimum necessary to support fish life, and within the tolerances required for spawning and growth, must be maintained. Fortunately, there are large-scale State and Federal programs designed to improve aquatic conditions by assisting in pollution abatement and control measures.

Spraying of large coastal areas with chemicals for the purpose of controlling insect life or vegetation carries a high potential for affecting the estuarine environment. We know relatively little about the characteristics of many of the chemicals used, or their effect on aquatic life. Gaining this knowledge before extensive damage is done is very important. There is a close relation between operations of this type and fishery resources and management. The effects of dieldrin applied at a rate of 1 pound per acre to a 2,000-acre coastal marsh in Florida, for instance, produced a substantially complete kill of fish and crustaceans.

Recent unpublished studies show that eggs and very young of striped bass are at least 30 times as susceptible to unidentified toxic substances in pulpmill wastes as are fathead minnows and goldfish. Just what the lethal levels are and the toxicant involved has not yet been determined. The wide variation in tolerance of chemicals by different species of fish and shellfish and at different stages in their life history, incidentally, can be a valuable means of controlling undesired or too-abundant populations.

Lack of foresight in industrial development and city planning has resulted in pollution situations in rivers throughout the whole northeast area. Not only have pollutants reduced the production from rivers but they also have been carried down to the seashore to affect production there.

Problems associated with rivers of the north-central area arise mostly from industrial and domestic pollution which, with the increase in population and corresponding industrial development, will increase to the point where many parts of certain water systems such as the Mississippi River and tributaries will be unfit for many forms of fish life. The result will be changes in species composition and probably in total production of fish. In many of these systems, less desirable species, some only suitable for industrial use, will remain. In some areas, therefore, the production of nonfood species of fish may exceed the former production of desirable food fishes.

As an example, the industrial expansion in the Illinois River drainage has been accompanied by

a decline in production of commercial fish in this river as shown in the following table:

	Pounds
1899	
1922	14,480,000
1950	9,901,000
1954	5,761,000
1957	3,433,000
	2,791,000

Serious problems of the quality of water also beset salmon populations. Soil erosion and silt deposition, caused by unstable flow patterns and inadequate flows, may result in smothering newly spawned, incubating fish, and the aquatic life upon which the young depend for their food. Temperatures are often too high and oxygen content too low. Return to the stream of irrigation water adds to the excessive temperature problem. Domestic and industrial pollution also have an adverse effect in some areas. Increased and stabilized streamflows would alleviate most quality problems. Excessive discharge of fresh waters during periods of flood has long been a problem in estuarine areas. The sudden entrance of many times the normal flow of water, usually silt laden, can and does have a catastrophic effect on marine organisms that cannot escape or survive the rapid change in water character. Upstream flood detention reservoirs that store these surplus waters and release them gradually are generally beneficial to the estuarine habitats. Conversely, retention of too much fresh water on a watershed may result in intrusion of highly saline water farther into the heads of estuaries so that valuable brackish water species, such as oysters, may be destroyed by favoring their parasites and predators.

A problem closely related to pollution is that of siltation, which not only has adverse effects upon aquatic life but also may shorten the life of reservoirs, many of which will become completely filled if precautions are not taken. Farm pond and reservoir studies have shown that turbidity may reduce the production of desirable fish species by as much as 80 percent through restriction of food supplies, reproduction, and growth. Turbidity is objectionable esthetically and implies upstream land practices which permit erosion.

The principal programs of the Fish and Wildlife Service in pollution control and abatement are in the research field and in bringing to the attention of water-project construction agencies the need of fish and wildlife resources in relation to the needs for pollution control. The Service cooperates closely with the Public Health Service which is the principal Federal agency having responsibilities in the pollution control and abatement field. The Fish and Wildlife Service is represented on several committees and boards which have responsibilities in the control of water pollution.

Example: The Roanoke River, Va.-N.C.—The Roanoke River in Virginia and North Carolina is an example of a stream where multiple use of water is rendered complex by the presence of serious pollution. The Roanoke River supports highly important sport and commercial fisheries, including the striped bass, shad, alewife, white perch and menhaden. These fishes use the lower Roanoke River for migration, spawning, and nursery areas. In the same area, the river receives large quantities of municipal and industrial wastes, including waste from pulpmills. Some of these wastes carry toxic substances; others have high oxygen demand. The Roanoke Rapids and Weldon, N.C., communities also depend on the river for their water supply. When dilution of the river falls below tolerable limits, or oxygen is reduced as a result of impoundment, fish kills have resulted.

Development of the lower Roanoke River is extensive. It consists of the John H. Kerr Dam and Reservoir, completed by the Corps of Engineers in 1952 at river mile 179 and located astride the North Carolina-Virginia State line. The Virginia Electric & Power Co., under a license granted by the Federal Power Commission built the Roanoke Rapids Dam at river mile 137 and placed it in operation in 1955. The same company is now seeking to construct the Gaston project on the Roanoke River, to be located between the Roanoke Rapids Reservoir and Kerr Dam. The effect of these dams has been to eliminate natural aeration of the river water and to reduce the levels of oxygen.

In order to initiate a solution of the most perplexing problems resulting from this combination of circumstances, Congressman Herbert C. Bonner of North Carolina called a meeting at Weldon on May 2, 1955. The meeting was attended by respresentatives of Federal and State agencies, industries, and private citizens with an interest in the Roanoke River. As a result, a Steering Committee for Roanoke River Studies was organized to draft and guide a comprehensive study of the many facets of the Roanoke River problems.

Special flows to be released for the benefit of the striped bass and for stream sanitation purposes were proposed and placed in effect for the duration of the study. The Service, as part of its contribution, obtained data on the commercial fishery for striped bass in Albemarle Sound which, in turn, depends upon the Roanoke River for spawning areas. The Service also made a study of the sport fishery in the river over a 3-year period. The U.S. Public Health Service contributed personnel and supervision to bioassay studies to determine the requirements of eggs and young of the striped bass. State agencies contributed to the studies and produced a classification of the river, plus intensive studies on oxygen requirements for pollution abatement. The Virginia Electric & Power Co. constructed a submerged weir at Roanoke Rapids Dam to increase the oxygen content of the released water.

In the fall of 1959, as a conclusion to its program, the steering committee drew up a set of recommendations for the Roanoke River so that adequate minimum flows and oxygen would be available for fish life and to neutralize the polluting substances entering the stream. The proposed Gaston Dam will include a submerged weir, so as to provide the highest possible quality of water, and initial impoundment will be made during the autumn and winter seasons to minimize the danger of an oxygen deficiency.

At the Roanoke Rapids project, recommendations include specific minimum releases of water from the reservoir on a year-around basis to maintain necessary minimum flows and pounds of oxygen. The project also serves to reregulate discharges from the John H. Kerr Reservoir which are provided for the striped bass or for other purposes. Minimum flows are stipulated by months, with provision for reducing the requirements on offpeak hours during weekdays as a water conservation measure. The anticipated inclusion of a daily oxygen requirement in a Federal Power Commission license will be a forward step in water management, achieved as a result of cooperative studies and effort so that the Roanoke River can serve all reasonable demands placed upon it. The program outlined above has been accepted by the agencies and interests represented and was presented to the Federal Power Commission in November 1959 for its guidance in granting a license for the Gaston project and a revision of the license for the Roanoke Rapids project.

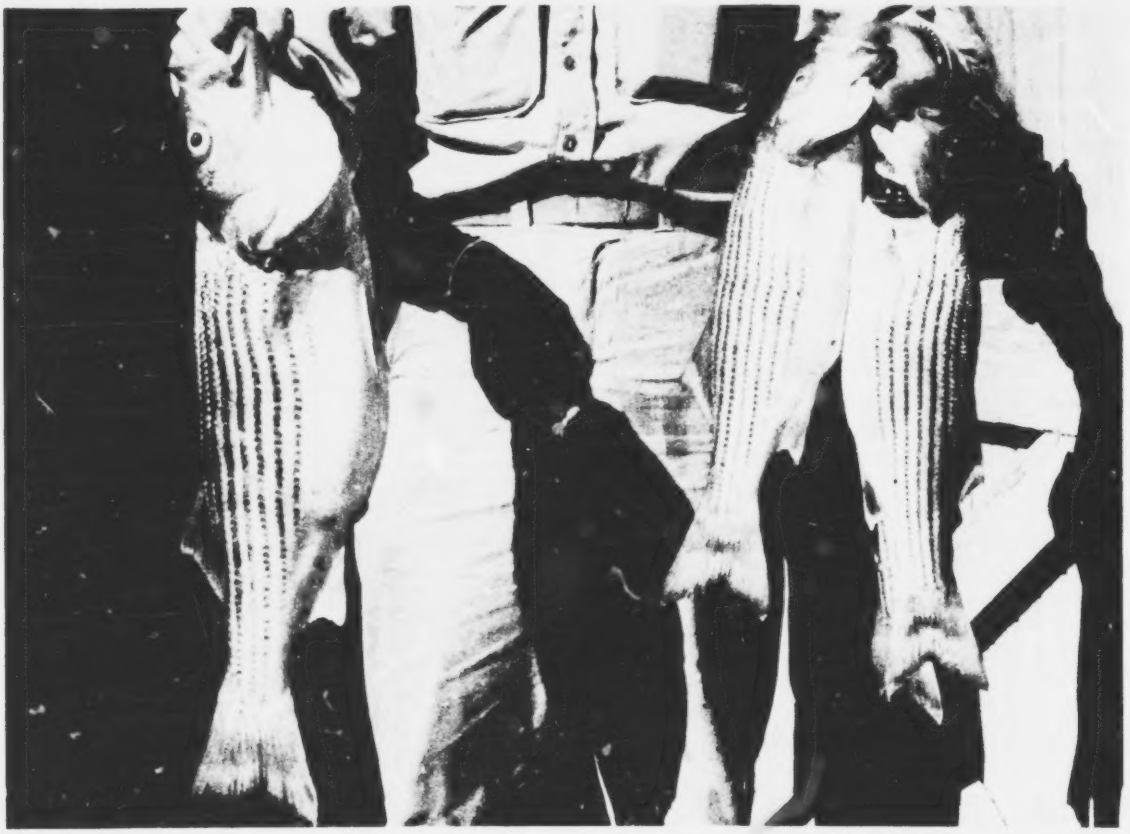
An employee of the U.S. Fish and Wildlife Service was the chairman of the steering committee and participated in many phases of the program. It can be seen from this example that clean water, with adequate dissolved oxygen, is vital to the preservation of important fisheries, as well as to other river uses. The American people have intense interest in this general problem. The Fish and Wildlife Service is committed to contributing its full share to the solution of problems of this nature.

Diversions for industry, irrigation, and other human uses

Demands for water for industry and human use, as noted, have been skyrocketing in recent years. Industrial and municipal needs for water are climbing sharply, while many thousands of acres of arid lands are being provided irrigation water. To meet these demands and the need for additional hydroelectric power, reservoirs are being constructed and diversion dams placed across streams to make water available at the times and places needed.

Fish and wildlife interests have a deep concern for these projects which take water from the rivers and streams of the Nation. Diversion of water profoundly changes the fish and wildlife habitat in the streams below and also the habitat of the land and water areas to which the water from the streams is diverted. One of the primary concerns is to assure that adequate downstream flows are maintained to preserve fish and other aquatic life. In its studies of these projects, the Fish and Wildlife Service develops recommendations on specific minimum flows which should be maintained in streams below the dams. The Service also recommends fish-passage facilities where the dams obstruct runs of migratory fish, and screens are often recommended to prevent fish from entering irrigation or power canals.

There have been many instances where very substantial numbers of fish have been lost in irrigation systems. In some cases, however, the construction of dams may provide an opportunity for maintaining consistent year-round streamflows below the dams where previously only intermittent flows occurred.



Striped bass like those above represent a splendid fishery resource of the Roanoke River. It supports much sport and commercial fishing as illustrated in the lower photograph taken near Weldon, N.C. Municipal and industrial pollution, combined with oxygen deficiency in water released from an upstream storage reservoir, threatens this fishery. Through cooperative study, a management plan has been developed to safeguard the vital spawning areas in this River. (North Carolina Wildlife Resources Commission photographs.)

54875 O—60——6

Irrigation projects, without considering reservoirs which usually make them possible, may be of substantial benefit to fish and wildlife resources. These projects commonly are constructed in arid regions where the introduction of water provides many benefits to fish and wildlife. Residues of crops grown on irrigated lands also are generally valuable as wildlife foods. Irrigation projects frequently provide an interspersion of food and cover types which usually are lacking in nature in these arid regions. On the other hand, when prairie lands are broken up into fields for irrigation and there is an influx of human population, some species of wildlife are bound to suffer.

There are numerous measures which can be incorporated in project plans for the benefit of fish and wildlife. Reports of the Fish and Wildlife Service may recommend the setting aside of specific lands for management of wildlife species. Reports of the Fish and Wildlife Service may recommend (1) ponding areas along irrigation canals for the benefit of both wildlife and fish. (2) fencing of large concrete-lined canals to prevent deer from entering the canals and drowning or being unable to escape, (3) constructing dirt-covered bridges for migrating deer to cross concrete-lined canals, (4) fencing specific canal and drain areas to provide protected habitat for wildlife, (5) planting food and cover plants for wildlife in some small areas otherwise unused in the irrigation system, (6) participation by fish and game agencies in organized weed and insect control planning to minimize wildlife losses that may result from the use of toxic herbicides and insecticides, and (7) provision for free public access to Federal lands for fishing and hunting purposes.

Example: The Garrison diversion unit, North Dakota.—The Garrison diversion unit, planned by the Bureau of Reclamation in North Dakota, is a project where waters of a major stream are diverted from their natural channel for irrigation and other human uses. Other purposes include fish and wildlife, recreation, pollution abatement, and flood control. The ultimate plan for the unit envisions the irrigation of some 1 million acres and the delivery of municipal water supplies to 41 towns and cities throughout the project area. Industrial water is planned for use at four cities within the project area.

This Cottonwood Lake area, North Dakota, is one of those recommended for development as a waterfowl management unit to mitigate the loss of breeding habitat in the Garrison diversion unit. Provision of adequate water for these areas through the irrigation system of the unit would maintain habitat during both wet and dry years.

The delivery system for this unit involves many miles of canals and laterals originating at Garrison Reservoir.

Highly important fish and wildlife resources occur in the project area. North Dakota has a complex of small and large potholes and marshes that make the State outstanding as a waterfowl-producing region. Many of these areas will be lost as a result of construction and operation of the project. The Fish and Wildlife Service has prepared a plan for developing some 62 areas, primarily to replace lost waterfowl habitat. An

integral feature of this plan is the provision of water to these areas to maintain satisfactory fish and wildlife habitat during wet and dry years alike. The plan also includes preservation of existing national wildlife refuges in the area.

Unusually close coordination among the various agencies involved has been maintained in developing the project plan. This has assured that all interests are given their rightful place in the plan. It is likely that a reduced initial plan will be proposed for construction at an early date.

Example: The Columbia Basin project, Washington.—One of the largest irrigation projects in the Nation, the Columbia Basin project in the State of Washington, under construction by the Bureau of Reclamation, was studied intensively by the Fish and Wildlife Service in cooperation with the Washington Department of Game. The project area, of approximately 1 million irrigable acres, is some 60 miles wide and about 100 miles long in a north and south direction. The project plan includes approximately 300 miles of main canals, 4,000 miles of secondary canals and laterals, and several hundred miles of natural and constructed drains and wasteways. The water, which is obtained from Franklin D. Roosevelt Reservoir behind Grand Coulee Dam, is stored in the 27-mile long equalizing reservoir from which it is taken to the irrigated lands. The Potholes Reservoir, which is located near the center of the project area, was constructed to capture return flows from the northern portion of the project for reuse on other lands.

The Fish and Wildlife Service report on the project concluded that significant benefits to fish and wildlife resources would result, amounting to some $1¾ million annually. This benefit was contingent upon the establishment of a national wildlife refuge, immediately downstream from the Potholes Reservoir, and State management areas. This facility, the Columbia National Wildlife Refuge, now comprising 26,302 acres, was established in 1944 and constitutes an important link in the national refuge system. The benefit was contingent also on the acceptance of other recommendations in the Fish and Wildlife Service report, which include such things as free public use of Federal lands except for portions reserved for purposes of safety, efficient operation, protection of public property, or management of wildlife refuges; the development of wildlife habitat along canals and drains; stipulation in leases of Federal lands of the right of public entry for hunting and fishing; participation of the Service and the Washington Department of Game in any planning for organized weed and insect control; cooperative efforts to alleviate deer losses in project canals; and the stabilization of water levels to the extent feasible in water areas within the project boundaries.

As recently as 1950, the Columbia Basin area consisted largely of arid, though fertile,, lands with a few permanent lakes, small towns, and communities. Much of the land was scab rock cut up by deep coulees and sandhills. It supported little game and fish.

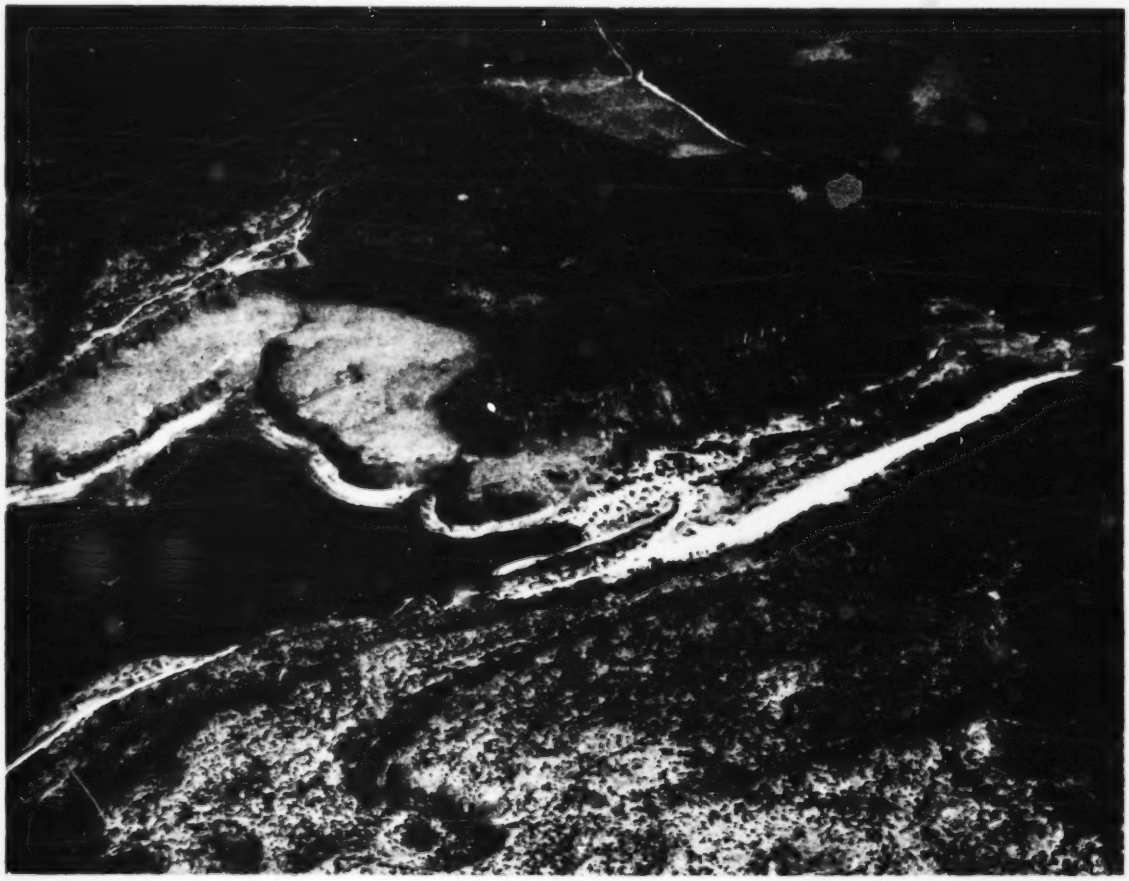
Today, this area is rapidly becoming one of the most productive of the State's farmlands, with growing towns, increasing amounts of game, and literally fabulous fishing in lakes which now exist where only rock and canyons have lain for thousands of years. The Columbia National Wildlife Refuge and other water areas in the project area are heavily used by waterfowl.

This is Blythe Lake on the Columbia National Wildlife Refuge, developed in connection with the Columbia Basin irrigation project. This lake is used by waterfowl mostly during the fall and winter.

The Columbia Basin project is another excellent example of what can be accomplished for fish and wildlife at irrigation projects through cooperative planning, construction, and operation of such projects.

Leveeing

Projects for the control of floods employ levees, in many cases, as primary features. Levees may



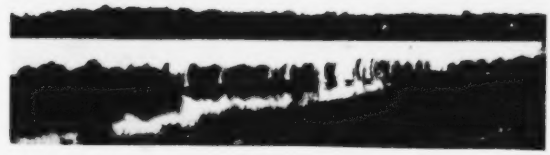
Goose Lake, adjacent to the Columbia Refuge, is a popular fishing spot which is reached only via refuge roads This is the opening day of the fishing season, 1958.

be damaging to fish and wildlife resources in that they prevent the periodic overflow of areas adjacent to rivers which are important for fish spawning and nursery areas and for waterfowl.

The Fish and Wildlife Service may recommend that certain lands within levee projects be acquired and made available for fish and wildlife management. The introduction of water into specified areas and management of such areas through the use of water-control structures can provide valuable fish and wildlife habitat. In other cases, the Service may recommend that sumps resulting from the project be managed for fish and wildlife purposes. Sometimes the Service recommends realinement of proposed levees so that certain areas can be preserved in their natural state. In many cases, the Service recommends that desirable wildlife food plants be established on the levees. These plants also serve to prevent erosion of the levee banks.

Example: Saginaw River flood control project, Michigan.—An unusually fine dual-purpose plan has been developed from a single-purpose plan for flood control in the Saginaw River Basin of Michigan. The Corps of Engineers' plan for flood control involves levees, channel enlargement and realinement, and development of emergency water storage reservoirs in the Shiawassee Flats.

In studying this plan the Fish and Wildlife Service found that the emergency storage reservoirs in Shiawassee Flats provided fine opportunities for waterfowl management. The Service prepared a detailed report proposing a combination flood control and fish and wildlife improvement plan which was adopted by the Corps of Engineers. The Chief of Engineers indicated that about 29



A dual purpose flood control-wildlife plan provides for emergency storage of floodwaters in this area of excellent waterfowl and fur animal habitat on Shiawassee National Wildlife Refuge, Mich. The refuge was established in connection with the Saginaw River flood control project of the Corps of Engineers.

percent of the cost of the project was allocated to fish and wildlife purposes. The Bureau of Sport Fisheries and Wildlife has established the 4,357-acre Shiawassee National Wildlife Refuge on the project area. The Migratory Bird Conservation Commission has authorized the enlargement of this refuge to 8,534 acres.

Drainage

Wetlands of the United States are disappearing at a rapid rate because of drainage programs. This matter is of great concern to the Bureau of Sport Fisheries and Wildlife since such lands provide vital habitat for many species of wildlife. Various species of fur animals and upland game make heavy use of wetland areas. Specific types of wetlands provide the best remaining habitat for big game animals in some sections of the country. Waterfowl, moreover, are dependent upon wetlands for their very survival.

Since the early 1950's, the Bureau of Sport Fisheries and Wildlife has carried on a program designed to stimulate preservation of wetlands, especially wetlands valuable as waterfowl habitat. In cooperation with the State fish and game agencies, an inventory of remaining wetlands was completed in 1954 with the publication of 48 State wetland inventories and a summary report entitled "Wetlands of the United States" (Fish and Wildlife Service Circular No. 39).

The subsequent program has included close study of the programs of other Federal agencies whose activities affect wetlands, and a continuing liaison with such agencies at appropriate levels. Contact has been maintained with all of the State fish and game departments and with private organizations of National, State, and local scope interested in wetland preservation. A number of organizations devoted to promoting wetland preservation has developed, largely as a result of the Bureau's program.

Example: Drainage of Prairie Pothole region, North Dakota, South Dakota, and Minnesota.—The wetland area of greatest concern to the Fish and Wildlife Service is the prairie pothole region of Minnesota and the Dakotas which provides the heart of the remaining waterfowl nesting areas in the United States. Extensive studies have shown that over a million acres of valuable waterfowl breeding habitat in this region have been drained with Federal assistance since 1943. Such technical and financial assistance is provided through the Department of Agriculture to farmers who wish to drain potholes and other wetlands. Studies have shown that elimination of Federal assistance for drainage in this area would save most of the habitat now being drained.

There is, of course, no suggestion of restricting the right of private landowners to drain their own lands without governmental assistance. There is however, serious question as to the desirability of providing Federal technical and financial assistance to drain lands of particular value to waterfowl, a resource for which the Federal Government has responsibilities under international treaties.

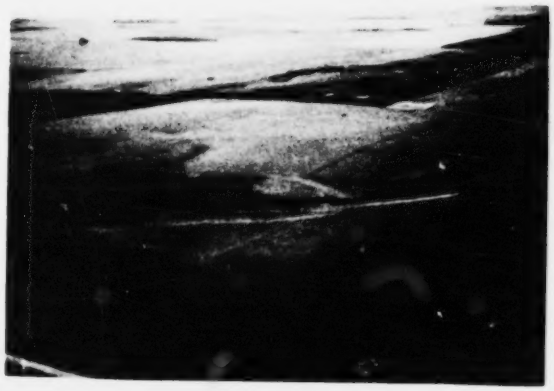
The Fish and Wildlife Service has maintained close liaison with the Soil Conservation Service and the Agricultural Conservation Program Serv-

ice of the Department of Agriculture in order to reach a solution of the problem. Although at times minor changes in regulations and guidelines by the agricultural agencies have promised some improvement, they have not been effective. At present, drainage in the prairie pothole region of the United States is on the increase.

Many interdepartmental meetings have been held on this problem. Hearings were held in 1957 by the Subcommittee on Inter-Governmental Relations of the House Government Operations Committee. Bills were introduced into the 85th and 86th Congresses to end Federal financial and technical assistance for drainage of wetlands important to waterfowl, but no action on them was taken. Floor discussions in the House of Representatives on the agricultural appropriations bill for fiscal year 1960 brought out that full cooperation by the Department of Agriculture in protecting wetlands for wildlife was expected.

The problem still remains, however, and our Nation's wetlands continue to disappear. The Fish and Wildlife Service will continue to take every possible step to preserve these areas which are so vitally needed by our waterfowl resources. The Service has initiated a program of purchase or lease of small wetlands in the prairie pothole region of Minnesota and the Dakotas, but this program can provide only a partial solution to the vexing problem.

Potholes like these in Burleigh County, N. Dak., are part of the most important duck breeding habitat in the conterminous United States. The complex of small water areas interspersed in farmlands is ideal for waterfowl production. Subsidized agricultural drainage is destroying these potholes at an alarming rate.



When drained and put to the production of grain, like this 12-acre pothole in Barnes County, N. Dak., potholes cannot produce waterfowl.

Small watershed projects

The improvement of specific watersheds is being planned and executed throughout the country through cooperative efforts of the Soil Conservation Service and Forest Service of the Department of Agriculture in conjunction with local watershed and soil conservation districts. The problems to be corrected include floodwater damage to crops and pasture, roads, bridges, and minor fixed improvements; sediment damage to flood plain lands; active interference with farming operations by overbank flows; and disruption of traffic caused by flooding of roads.

The works of improvement planned to combat such problems include such measures as installation of floodwater retarding structures, the improvement of stream channels, tree planting and timber stand improvement, fire control, roadbank and gully stabilization, and land treatment measures such as crop rotation, pasture planting, waterway development, pond construction, terracing, drainage, contour strip cropping, and wildlife-area planting.

The Fish and Wildlife Service studies the watershed work plans and proposes measures for the prevention of losses and improvement of fish and wildlife resources. These studies are made in accordance with section 12 of the Watershed Protection and Flood Prevention Act, noted earlier, and appended to the report. The act includes an amendment adopted in 1958 providing for Federal sharing in the cost of small watershed

projects on account of fish and wildlife benefits. To date, however, this provision has been little used by local groups sponsoring these projects.

Recommendations made by the Service may include storage capacity in reservoirs for fish and wildlife development, modification of reservoir structures, marsh development, and improvement of stream channels by herbaceous, tree, or shrub plantings and fencing.

Example: Flat Creek watershed project, Arkansas.—An outstanding example of a small watershed project in which development for fish and wildlife has been planned is the Flat Creek watershed project in Lawrence County, Ark. This project is sponsored by the Lawrence County Soil Conservation District and the Arkansas Game and Fish Commission in cooperation with the Soil Conservation Service and has been approved for construction. This watershed comprises an area of 24,050 acres lying east of the Black River. The watershed protection measures will include contour farming, cover cropping, crop residue utilization, brush control, pasture planting, proper land use, diversion construction, farm ponds, terracing, water development, drainage, land leveling, critical area stabilization, channel improvement, and construction of flood detention structures.

A multiple-purpose flood detention structure is planned which will provide a 645-acre fish and wildlife lake. This lake will be managed for public fishing and will provide 5,542 acre-feet of usable storage capacity for flooding approximately 4,000 acres of bottomland hardwood forest on the Shirey Bay-Rainey Brake game restoration area lying adjacent to the Flat Creek project area. This 9,000-acre area is owned and managed by the Arkansas Game and Fish Commission as a public hunting area. About 1,200 of the 4,000 acres of optimum waterfowl wintering habitat flooded with the stored water will be set aside as a refuge.

The provision of a reliable water supply will permit stabilization of water levels during summer in various sloughs on the management area for fishing and as wood duck breeding habitat.

In addition, the watershed runoff from another 4.8 square miles will be available for use on the game restoration area through the multiple-purpose floodwater diversion canal which conveys the stored water from the fish and wildlife reservoir to the management area.

Flat Creek Reservoir is a multiple-purpose facility of the Flat Creek small watershed project, Arkansas. In addition to flood control it will supply water for maintaining summer water levels for fishing in Hill Slough, shown above, and for winter flooding of waterfowl habitat on the Shirey Bay-Rainey Brake game restoration area administered by the Arkansas Game and Fish Commission.

To achieve this very desirable fish and wildlife development in the Flat Creek watershed project, the Arkansas Game and Fish Commission provided 53.9 percent of the costs of the fish and wildlife development and Public Law 566 provided 46.1 percent. The total cost of the Flat Creek watershed project was $909,723, of which $198,776 was allocated to fish and wildlife development.

Highway construction

The construction of new highways has tremendous potential for damage to fish and wildlife resources of our Nation. At the same time highway programs offer many splendid opportunities for improvement of these resources.

Some of the types of damage done to fish and wildlife by highway construction are: (1) improper installation of road culverts so that they form an impediment to the passage of migratory fish; (2) the imposition of superhighways across productive waterfowl marshes; (3) the destruction of fish habitat in streams through dredging and filling and subsequent siltation; (4) the widening of stream channels, thus permitting warmer and shallower water which are undesirable for fish; (5) the rerouting of stream channels through barren, dredged cuts which may be impassable for migratory fish; and (6) providing outlets for drainage of valuable wetlands.

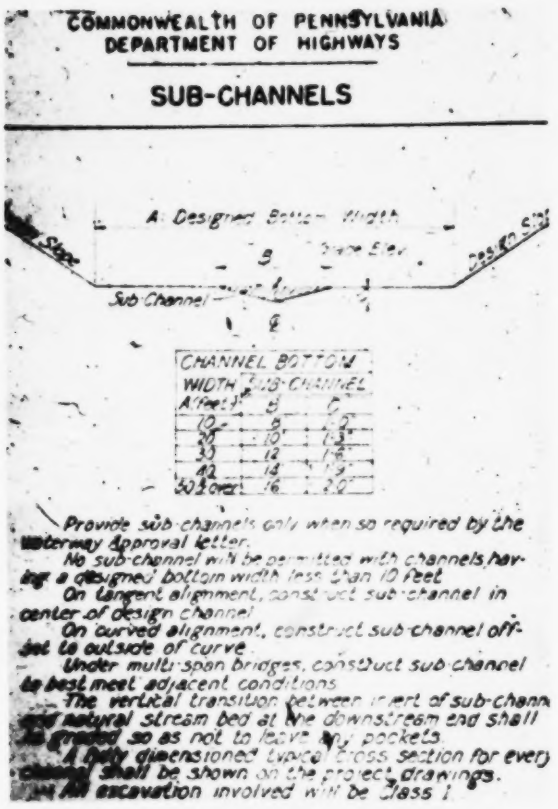
On the other hand, when highway construction agencies are aware of the damages to fish and wildlife caused by some of the methods they use, they may be able to change construction procedures so as to preserve fish and wildlife habitat without unduly interfering with the road construction. Properly installed road culverts usually do not impede passage of migratory fish; highways sometimes can be routed around important waterfowl marshes; the extent of destruction of stream channels by construction equipment often can be reduced; and stream channels often can be maintained at sufficient depth and characteristics so as to preserve fish habitat.

For example, the Pennsylvania Highway Department now provides to all its contractors a copy of channel specifications designed to concentrate the waters in times of low flow, thus keeping them cooler than would otherwise be possible.

As mentioned above, the highway programs of this country have great potential for fish and wildlife conservation. Many road embankments are especially well suited to the creation of small ponds and marsh areas. Impoundments designed solely for waterfowl generally can be quite shallow, and in most cases would require only 1 to 3 feet of water against a highway fill. Impoundments designed solely for fish or for both fish and wildlife would generally be deeper. Fish and game biologists usually can design management plans for specific sites that will not adversely affect the highway.

In many cases, modifications of highway embankments and other highway features to

Joint benefits to highway construction and to fish and wildlife conservation resulted when the Maryland Game and Inland Fish Department provided $40,000 for construction of this outlet structure and created a 35-acre fishing lake which otherwise would have cost $100,000. (Maryland Game and Inland Fish Department photograph.)


COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF HIGHWAYS
SUB-CHANNELS
A Designed Bottom Width
Sub Channel
CHANNEL BOTTOM WIDTH
SUB-CHANNEL
Provide sub-channels only when so required by the Waterway Approval Letter.
No sub-channel will be permitted with channels having a designed bottom width less than 10 feet.
On tangent alignment, construct sub-channel in center of design channel.
On curved alignment, construct sub-channel offset to outside of curve.
Under multi-span bridges, construct sub-channel to best meet adjacent conditions.
The vertical transition between invert of sub-channel and natural stream bed at the downstream end shall be graded so as not to leave any pockets.
A fully dimensioned typical cross section for every channel shall be shown on the project drawings.
All excavation involved will be Class 1.

By cooperative agreement, the above specifications were adopted to protect fish habitat in streams at highway crossings in Pennsylvania. (Pennsylvania Fish Commission photograph.)

serve fish and wildlife conservation can be accomplished with very little extra cost. It may be possible in some cases for the State highway departments to include such cost in their construction programs. In other cases, State fish and game departments may desire to use some of their funds for the purchase of such items as gated culvert structures and land along highways for the benefit of fish and wildlife.

Working relationships have been established between the Fish and Wildlife Service and the Bureau of Public Roads to further the cooperative efforts. Field personnel of these agencies, as well as personnel of State fish and game departments and State highway departments, are encouraged and assisted in taking advantage of opportunities for creation and preservation of fish and wildlife habitat in connection with Federal-aid highway planning and construction.

Saline barriers

The construction of saline barriers to prevent salt water intrusion into streams and agricultural lands is a new type of water-development proposal which is now undergoing study by the Fish and Wildlife Service.

Low-lying lands and streams along coastal areas are subject to intrusion of saline waters from the oceans. As flows of the streams are reduced and water tables lowered due to increased usage of water for municipal, industrial, agricultural, and other purposes, ocean waters may penetrate further inland. This causes damage to agricultural lands and deterioration of water quality for the above purposes. Fish and wildlife habitat also may undergo substantial changes.

In order to prevent the undesirable effects of salt water intrusion in certain areas, several Federal agencies and States are studying corrective measures which might be undertaken. One of the most promising measures under study is the construction of dams across the streams affected to prevent intrusion of saline waters during periods of low streamflows. Such dams often would require ship locks and sometimes additional facilities for the passage of migratory fish.

Example: Saline barrier, San Francisco Bay, Calif.—The Service is studying plans being drawn up by the Corps of Engineers for construction of saline barriers in San Francisco Bay, Calif. Fish and wildlife resources of the San Francisco Bay area are extremely valuable to the people of California and the Nation. Construction of saline barriers and the consequent reclamation of tidelands would have a great impact upon fish and wildlife, particularly anadromous fish, marine invertebrates, and waterfowl. Such barriers would eliminate the transition zone from sea to fresh water; some saline tidelands or brackish marshes would be converted into fresh-water marshes with attendant changes in vegetative cover; and tidelands would be converted into agricultural areas. Problems of passing fish from a marine to fresh-water habitat are many, and more data on responses of fish to these changes are needed before fish passage can be solved. Some of the major

physical factors which directly affect plant and animal associations are water salinities, depths, level fluctuations, turbidity, sedimentation, pollution, and temperatures; control of vegetation; disease vector control; tideland reclamation; industrial and urban expansion; and physical structures.

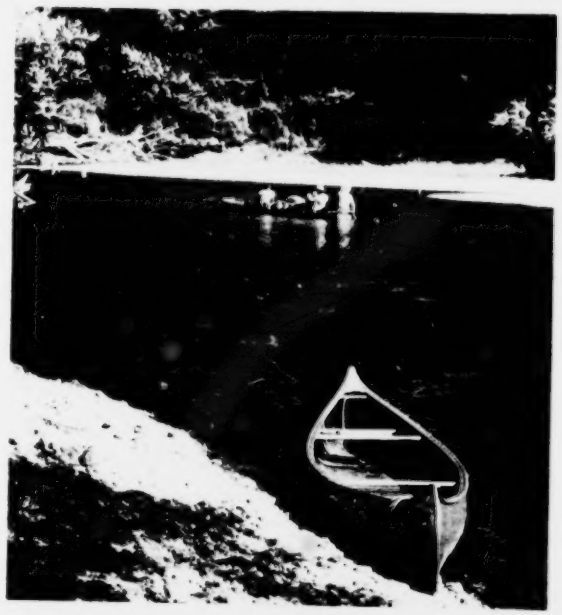
The saline barrier plans under study would have varying effects on these factors. Studies now underway by the Fish and Wildlife Service are designed to ascertain what effects saline barriers would have on fish and wildlife resources and to develop measures for the conservation and improvement of these resources. Much study still is required to develop measures for preservation of the valuable fish and wildlife resources involved.

Reservation from development

It has been brought out here that the need of the Nation for water and water resources development has brought a tremendous demand for impoundments and other water control on nearly every one of the Nation's rivers where there are feasible sites for dams and reservoirs. However, there is needed a policy to reserve some of the streams in the Nation in their natural state because of their outstanding character from a fish and wildlife and outdoor recreation standpoint. In these cases, there is little which can be done in the way of modifications in project construction and operation plans to preserve the natural values which make these areas outstanding.

It is recognized that the number of such areas reserved from water resources development will have to be few, in the light of the increasing need for water development. Nevertheless, there should be recognition in the water policies of the Nation that there are some areas which contribute to public benefit most by being left unaltered in their natural state. In such cases, it can be demonstrated that the natural characteristics are more valuable to the public than the benefits which would be created by the development of a water resources project, with the attendant loss of the natural values.

As suggested earlier in this report, the criteria for reserving streams from water resources development should not be based on computed dollar values. The values which would be preserved by such a policy are beyond monetary measurement.



The Current River, Ark.-Mo., an outstanding float-fishing stream, is an example of a river which has been recommended for reservation from further development in order to preserve its outstanding sport fishery values. (Missouri Conservation Commission photograph.)

Clear streams, which are natural in their settings, nice to look at and pretty to fish in, have a certain esthetic

value which despise the dollar. Some of these, at least, must be conserved if we are to leave to our sons and daughters what this country naturally provided to us and to our forefathers.[3]

Example: The Current River, Ark. and Mo. The Current River, a south-flowing tributary of the White River, in Arkansas and Missouri, is an example of the reservation policy. The Current River provides outstanding opportunities for float fishing. In this type of use, boats may drift downstream amid lovely outdoors settings with their passengers enjoying a relaxing type of sport which can be duplicated in only a few places elsewhere in the Nation. The Current, however, also offers good opportunities for water impoundment.

[3] Luna B. Leopold.

The Arkansas-White-Red River Basin Interagency Committee, established in accordance with the Flood Control Act of 1950, gave lengthy consideration to these matters in connection with the development of its comprehensive plan. This Committee consisted of representatives of the Corps of Engineers, the Department of the Interior, and other interested Federal agencies, and the States of the basins. The conclusion and recommendation of the Committee were that no reservoir should be planned on the Current River in order that its natural values could be preserved. This conclusion was reached despite the recommendation of the Committee for reservoirs at nearly every other available site in the 282,000-square-mile area of the three river basins.

Chapter III. Future Demand for Fish and Wildlife Resources

In order to attempt an estimate of future water requirements for fish and wildlife resources, estimates have been made here on future demands by the Nation for these resources in each of 24 water resource regions identified for analysis by the Senate Select Committee on National Water Resources. The 22 regions of conterminous United States are shown on the map following this page. The other two are Alaska and Hawaii.

Sport Fisheries and Wildlife

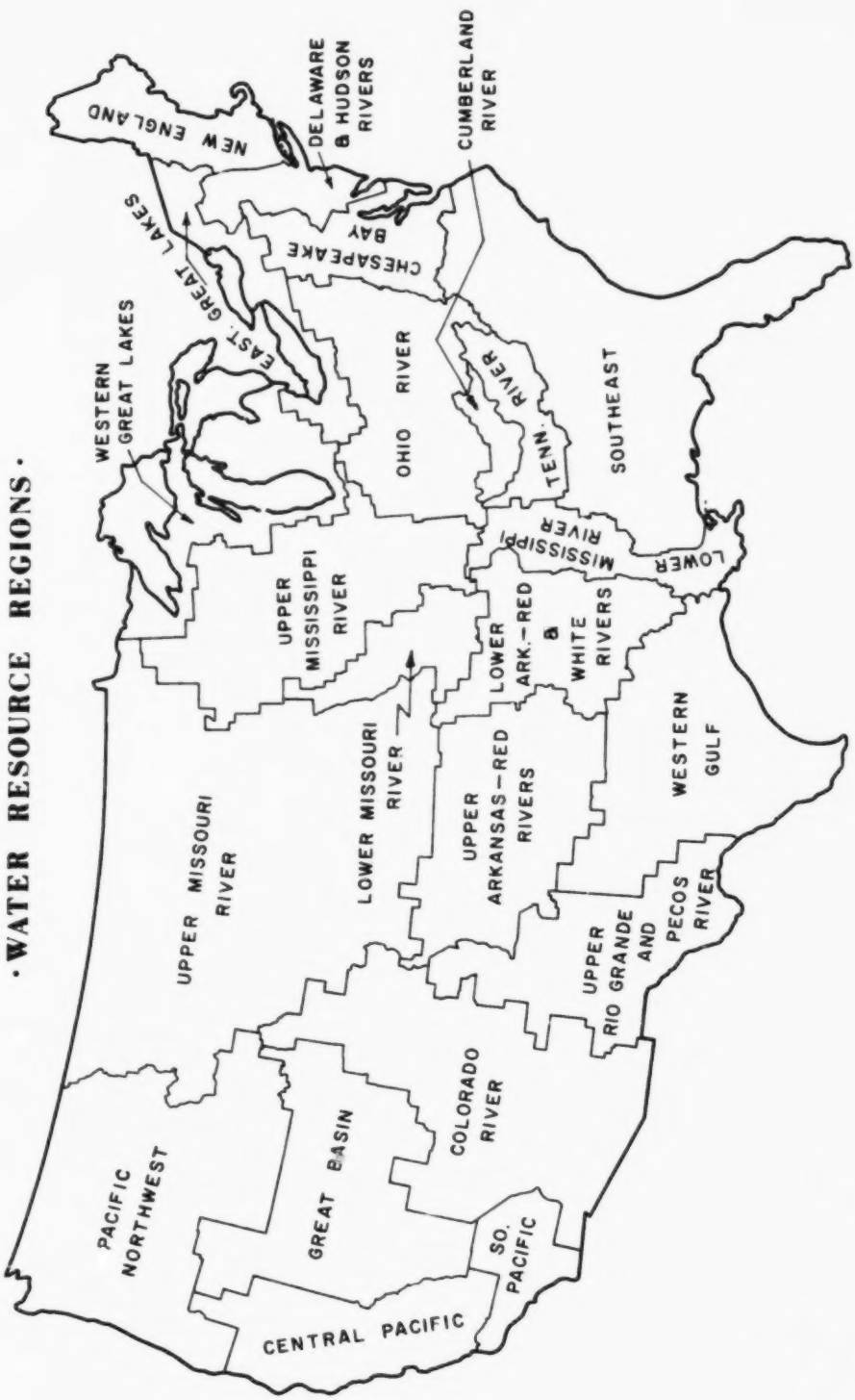
On the basis of assumptions outlined below tremendous increases in demand for recreational fishing and hunting are forecast during the remainder of the century. The number of persons hunting and or fishing will triple, man-days of fishing will triple and man-days of hunting will more than double. Expenditures for both fishing and hunting are expected to reach $8.7 billion annually by the year 2000.

It has been assumed here that participation in sport fishing and hunting is dependent upon such factors as the human population, income level, amount of leisure time, and the availability of fishing and hunting opportunities. Both the average income and leisure time per capita in the United States have been increasing over the years and these trends are expected to continue in the future. Fishing opportunities are expected to increase in number in future years with the construction and improved management of artificial impoundments, reduction of stream pollution, increased interest in marine sport fishing, and utilization of presently underutilized fish species. On the other hand, the availability of hunting opportunities is expected to decrease in future years due to increasingly intensive agricultural practices and the inevitable expansion of industries, cities highways, airports, reservoirs, and other commercial developments into areas presently providing wildlife habitat or serving as hunting sites.

In the future, participation in fishing is expected to continue its rapid expansion as population increases and additional fishing opportunities become available. On the other hand, participation in hunting is expected to increase at a less rapid rate than in fishing because of decreasing opportunities for hunting. Future hunters probably will have to be satisfied with smaller harvests than at present since the game populations will be smaller in comparison with the number of hunters in the field.

Assuming that fishing license sales will increase at a rate somewhat more rapid than population to 1980 and in direct ratio thereafter, it is estimated that there will be 47 million fishermen in 1980 and 63 million fishermen in 2000 as compared with 21 million in 1954. It is also expected that these fishermen will expend 930 million man-days and $4.5 billion in 1980 as compared with $1.9 billion in 1954.

Under an assumption that the number of



·WATER RESOURCE REGIONS·

hunters will increase in proportion to population, it is expected that 23 million hunters will spend 330 million man-days and $1.8 billion in 1980, and 31 million hunters will spend 440 million man-days and $2.5 billion in 2000 in connection with hunting as compared with 1954 when 12 million hunters spent 169 million man-days and $940 million.

These indicators of fishing and hunting demands are presented in tables 2 and 3. The data are shown by the 22 river basins of conterminous United States shown on the accompanying map.

COMMERCIAL FISHERIES

Estimates of the production of fresh-water-dependent species are given in tables 5 and 6; production in 1954 the base year for this study, is shown in table 4 for comparison. The estimates for 1980 and 2000 were based upon the best judgment of experienced personnel of the Bureau of Commercial Fisheries throughout the country. A basic list of assumptions was used, but only as a guideline, there being considerable latitude for the exercise of individual judgment. The important assumptions were:

1. Population of the conterminous United States will increase from 162 million in 1954 to 244 million in 1980, and to 329 million in 2000, exclusive of persons overseas. Increase in population of the 22 conterminous areas will follow the "medium" prediction prepared by Resources for the Future, Inc. No population projections were made for Alaska and Hawaii, and Bureau personnel were asked to use their own judgment.

2. Consumption of fishery products will remain at about 11 pounds per person per year, as it was in 1954, or increase somewhat if sufficient high-quality products are available at reasonable cost. This will require the utilization of all acceptable edible species of fish and shellfish by 2000, and this trend may be well underway by 1980.

3. Fish prices may increase substantially in future years (exclusive of inflation) because of scarcities and increased costs of production owing to expansion to more distant fishing grounds and new methods of "farming," which are more costly than present fisheries based on wild stocks.

4. Improved methods for culturing fresh-water fishes, some estuarine fishes, and all shellfish species must be developed by 1980. Growth and production will be further increased through selective breeding by 2000. Methods for reuse-fertilization, and purification of water will be developed. Such technological advances will make it possible to produce enough fishery products to supply the needs of the expanded population if sufficient support is given to research programs for the development of methods and techniques for cultivation.

TABLE 2.—*Estimated number of hunters, days hunted, and hunter's expenditures in 1954, 1980, and 2000*

[In thousands]

Water resource region	Number of hunters [1]			Man-days of hunting [1]			Dollar expenditures [2]		
	1954	1980	2000	1954	1980	2000	1954	1980	2000
New England	394	615	740	5,671	8,843	10,638	31,353	48,890	58,814
Delaware and Hudson Rivers	751	1,410	1,792	10,799	20,266	25,758	59,704	112,044	142,408
Chesapeake Bay	879	1,846	2,584	12,643	26,540	37,156	69,899	146,731	205,424
Eastern Great Lakes	712	1,342	1,868	10,242	19,293	26,856	56,625	106,665	148,478
Ohio River	1,305	2,123	2,781	18,741	30,526	39,980	103,614	168,770	221,093
Cumberland River	115	206	233	1,658	2,959	3,353	9,167	16,359	18,538
Tennessee River	340	705	803	4,892	10,142	11,552	27,046	56,072	63,867
Southeast	1,131	2,717	3,701	16,259	39,066	53,208	89,891	215,984	294,171
Western Great Lakes	1,114	2,132	2,918	16,021	30,664	41,948	88,575	169,532	231,918
Upper Mississippi River	1,251	1,992	2,506	17,980	28,644	36,034	99,407	158,365	199,221
Lower Mississippi River	290	486	563	4,175	6,993	8,091	23,082	38,662	44,733
Upper Missouri River	810	1,286	1,506	11,640	18,487	21,649	64,354	102,209	119,691
Lower Missouri River	208	522	562	2,989	7,500	8,077	16,525	41,465	44,655
Upper Arkansas-Red Rivers	291	506	605	4,178	7,277	8,703	23,099	40,232	48,116
Lower Arkansas-White-Red Rivers	338	472	459	4,866	6,780	6,604	26,903	37,485	36,511
Western Gulf	263	722	1,009	3,780	10,377	14,508	20,898	57,371	20,210
Upper Rio Grande and Pecos Rivers	104	250	389	1,493	3,595	5,594	8,254	19,876	30,927
Colorado River	261	673	1,020	3,757	9,670	14,669	20,771	53,462	81,100
Great Basin	161	412	664	2,312	5,923	9,542	12,782	32,746	52,755
Pacific Northwest	604	961	1,436	8,680	13,818	20,644	47,989	76,395	114,134
Central Pacific	403	1,406	2,354	5,792	20,217	33,843	32,022	111,773	187,107
South Pacific	59	204	323	855	2,932	4,641	4,727	16,210	25,659
Total	11,784	22,988	30,816	169,423	330,512	443,058	936,687	1,827,298	2,449,530

[1] Estimates for 1954 are based on State license sales and data obtained during National Survey of Fishing and Hunting, 1955. These estimates were extended to 1980 and 2000 on the basis of population projections developed by Resources for the Future, Inc.

[2] Expenditures reported cover items purchased in connection with participation in the sport. These include costs of such items as equipment, transportation, meals, lodging, and stamps and licenses. Deductions were made to account for the average cost of food which would have been consumed at home. Transportation costs were not included for trips in which fishing and hunting were only incidental activities.

TABLE 3.—*Estimated numbers of sport fishermen, days fished, and fishermen's expenditures in 1954, 1980, and 2000*

[In thousands]

Water resource region	Number of fishermen [1]			Man-days of fishing [1]			Dollar expenditures [2]		
	1954	1980	2000	1954	1980	2000	1954	1980	2000
New England	825	1,433	1,724	15,683	28,660	36,203	75,537	138,040	174,371
Delaware and Hudson Rivers	866	1,962	2,494	16,451	39,239	52,367	79,236	188,994	252,224
Chesapeake Bay	1,046	2,637	3,692	19,879	52,784	73,848	95,747	254,059	355,587
Eastern Great Lakes	1,032	2,255	3,139	19,615	45,098	62,776	94,475	217,213	302,359
Ohio River	2,209	2,934	5,285	41,971	80,680	110,985	202,152	388,593	534,556
Cumberland River	271	524	594	5,150	10,482	12,470	24,805	50,486	60,061
Tennessee River	659	1,455	1,658	12,527	29,109	34,813	60,336	140,203	167,676
Southeast	1,955	5,467	7,447	37,601	109,347	156,377	181,104	526,667	753,185
Western Great Lakes	1,878	3,771	5,159	35,681	75,417	108,329	171,857	363,244	521,763
Upper Mississippi River	2,925	6,176	7,770	57,098	123,529	155,400	275,010	594,973	748,480
Lower Mississippi River	506	982	1,136	9,620	19,644	22,728	46,334	94,615	109,469
Upper Missouri River	1,380	2,558	2,995	26,219	51,152	62,893	126,283	246,372	302,922
Lower Missouri River	454	756	814	8,635	15,120	17,098	41,590	72,825	82,352
Upper Arkansas-Red Rivers	617	1,009	1,207	11,715	20,182	25,345	56,425	97,206	122,073
Lower Arkansas-White-Red Rivers	731	1,023	997	13,894	20,470	20,934	66,920	98,593	100,828
Western Gulf	424	1,345	1,879	8,050	26,902	39,461	38,773	129,573	190,063
Upper Rio Grande and Pecos Rivers	175	407	633	2,944	8,131	13,285	14,180	39,163	63,987
Colorado River	442	1,398	2,120	8,396	27,956	44,529	40,439	134,649	214,473
Great Basin	281	862	1,389	5,345	17,240	29,163	25,744	83,036	140,463
Pacific Northwest	845	1,570	2,345	16,047	31,395	49,249	77,290	151,213	237,206
Central Pacific	1,142	4,272	7,151	21,701	85,431	150,161	104,522	411,476	723,246
South Pacific	170	622	985	3,225	12,447	20,688	15,533	59,951	99,643
Total	20,813	46,518	62,613	397,447	930,379	1,299,102	1,914,292	4,481,144	6,257,087

[1] Estimates for 1954 are based on State license sales and data obtained during National Survey of Fishing and Hunting, 1955. These estimates were extended to 1980 and 2000 on the basis of population projections developed by Resources for the Future, Inc.

[2] Expenditures reported cover items purchased in connection with participation in the sport. These would include costs of such items as equipment, transportation, meals, lodging, and stamps and licenses. Deductions were made to account for the average cost of food which would have been consumed at home. Transportation costs were not included for trips in which fishing and hunting were only incidental activities.

TABLE 4.—*Pounds and value of commercial catch of fresh-water-dependent species in 1954*

[In thousands]

Water resource region	Fresh water		Anadromous		Estuarine		Total	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
New England	78	$6	8,033	$224	83,483	$7,504	91,594	$7,734
Delaware and Hudson Rivers	408	88	2,224	375	808,476	22,464	811,108	22,927
Chesapeake Bay	7,058	567	40,478	1,922	400,964	27,166	448,400	29,655
Eastern Great Lakes	28,650	3,960					28,650	3,960
Ohio River	10,000	1,100					10,000	1,100
Cumberland River	510	90					510	90
Tennessee River	29,500	1,600					29,500	1,600
Southeast	6,935	1,456	16,406	763	457,609	32,663	480,950	34,882
Western Great Lakes	51,100	5,880					51,100	5,880
Upper Mississippi River	28,100	2,530					28,100	2,530
Lower Mississippi River	36,300	1,550			235,300	21,700	271,600	23,250
Upper Missouri River	2,490	150					2,490	150
Lower Missouri River	400	40					400	40
Upper Arkansas-Red Rivers	324	40					324	40
Lower Arkansas-White-Red Rivers	15,180	1,840					15,180	1,840
Western Gulf	20	2			306,000	25,700	306,020	25,702
Rio Grande-Pecos Rivers								
Colorado River								
Great Basin								
Pacific Northwest	400	40	72,600	17,130	11,300	2,030	84,300	19,200
Central Pacific	600	50	9,900	2,790	1,100	130	11,600	2,970
South Pacific			315	98	47	22	362	120
Alaska	100	10	247,100	24,600	10		247,210	24,610
Hawaii								
Total	218,153	20,999	396,956	47,902	2,304,289	139,379	2,919,398	208,280

TABLE 5.—*Projected pounds and value of commercial catch of fresh-water-dependent species in 1980*

[In thousands]

Water resource region	Fresh water		Anadromous		Estuarine		Total	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
New England	100	$10	22,000	$880	150,000	$18,000	172,100	$18,890
Delaware and Hudson Rivers	500	120	2,700	500	1,055,000	30,000	1,058,200	30,620
Chesapeake Bay	9,100	760	48,500	2,600	480,000	36,300	537,600	39,660
Eastern Great Lakes	50,000	8,300					50,000	8,300
Ohio River	5,000	350					5,000	350
Cumberland River	5,000	1,000					5,000	1,000
Tennessee River	40,000	6,000					40,000	6,000
Southeast	8,300	2,000	19,800	1,000	549,000	44,000	577,100	47,000
Western Great Lakes	78,000	10,600					78,000	10,600
Upper Mississippi River	25,000	3,000					25,000	3,000
Lower Mississippi River	43,500	2,100			282,000	29,100	325,500	31,200
Upper Missouri River	10,000	1,100					10,000	1,100
Lower Missouri River	3,000	500					3,000	500
Upper Arkansas-Red Rivers	3,000	600					3,000	600
Lower Arkansas-White-Red Rivers	20,000	3,600					20,000	3,600
Western Gulf					368,000	34,600	368,000	34,600
Rio Grande-Pecos Rivers								
Colorado River								
Great Basin								
Pacific Northwest	1,500	200	117,300	32,020	32,700	7,060	151,500	39,280
Central Pacific	800	80	12,000	3,700	3,800	920	16,600	4,700
South Pacific			500	200	100	40	600	240
Alaska	100	10	439,000	52,200			439,100	52,210
Hawaii								
Total	302,900	40,330	661,800	93,100	2,920,600	200,020	3,885,300	333,450

TABLE 6.—*Projected pounds and value of commercial catch of fresh-water-dependent species in 2000*

[In thousands]

Water resource region	Fresh water		Anadromous		Estuarine		Total	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
New England	100	$10	32,000	$1,350	216,000	$34,000	248,100	$35,360
Delaware and Hudson Rivers	600	170	3,200	740	1,130,000	44,000	1,133,800	44,910
Chesapeake Bay	9,900	1,100	57,000	3,800	695,000	53,500	761,900	58,400
Eastern Great Lakes	78,000	15,300					78,000	15,300
Ohio River	15,000	1,900					15,000	1,900
Cumberland River	10,000	2,400					10,000	2,400
Tennessee River	60,000	9,000					60,000	9,000
Southeast	9,700	2,800	23,000	1,500	642,000	64,100	674,700	68,400
Western Great Lakes	109,000	17,400					109,000	17,400
Upper Mississippi River	35,000	4,800					35,000	4,800
Lower Mississippi River	50,800	3,000			329,000	42,500	379,800	45,500
Upper Missouri River	20,000	2,500					20,000	2,500
Lower Missouri River	5,000	1,000					5,000	1,000
Upper Arkansas-Red Rivers	5,000	1,200					5,000	1,200
Lower Arkansas-White-Red Rivers	60,000	12,600					60,000	12,600
Western Gulf					430,000	50,300	430,000	50,300
Rio Grande-Pecos Rivers								
Colorado River								
Great Basin								
Pacific Northwest	4,700	700	163,200	48,270	56,500	14,440	224,400	63,410
Central Pacific	1,200	130	15,000	5,500	5,900	2,200	22,100	7,830
South Pacific			700	260	200	110	900	370
Alaska	100	20	675,600	95,000			675,100	95,020
Hawaii								
Total	474,100	76,030	969,100	156,420	3,504,600	305,150	4,947,800	537,600

Chapter IV. Water Requirements for Fish and Wildlife

Water requirements for fish and wildlife may be classed in two general categories. One category is water needed to support specific installations devoted wholly to the production and conservation of these resources like fish hatcheries and wildlife refuges. The other, much harder to estimate, is water in streams, lakes, reservoirs, and estuaries which supports the bulk of the Nation's fish and wildlife resources yet which is not subject to control or appropriation by fish and wildlife interests.

The estimate here presented shows a requirement in the year 2000 of 273,500,000 acre-feet of fresh water for inland sport fishing; 191,717,000 acre-feet for wildlife; 73,900,000 acre-feet for inland commercial fisheries; and 1,010 million acre-feet for fresh-water introduction into estuaries.

Inland sports fishery

Water requirements for sport fisheries (table 7) have been estimated on the basis of expected demand for sport fishing measured against the estimated yield of fishing waters in the basin. Demand was measured through projections of fishing license sales which, in turn, were based primarily on projections of population by the Census Bureau and Resources for the Future, Inc. Numbers of fishermen were estimated by use of these license sales projections, adjusted to account for unlicensed fishermen as reported in the National Survey of Fishing and Hunting, 1955.

The national survey found that fishermen spent an average of 19 days annually pursuing their sport. It was assumed that the average might increase to 20 and 21 in 1980 and 2000 respectively. Multiplication of the number of fishermen by the average number of days spent fishing yielded an estimate of total man-days of fishing expected in the basin. An average daily catch of 2.2 pounds of fish per fisherman is reported by the Sport Fishing Institute, based on its summarization of a number of creel studies over the Nation. Multiplication of fishermen-days by the average catch per fisherman yielded an estimate of the total sport catch in pounds per basin. Productivity of fishing waters was estimated for the various regions on the basis of limited information available. This productivity was estimated in terms of pounds of fish per surface-acre and converted to acre-feet of water for each of 24 water resource regions. Finally, projected demand was converted to pounds of fish and to acre-feet of water.

Precipitation and streamflow during 1954 were substantially below average in all areas except the Northeast, Pacific Northwest, and upper Mississippi. Water supply was probably adequate to support the 1954 requirements in most areas except the Great Plains, Great Basin, and Southwest. Here, particularly, water supplies are always short of requirements for sport fishing.

The estuarine requirements discussed below under "Commercial fisheries" also accommodate the substantial and growing marine sports fishery, previously mentioned, which furnishes a catch of somewhat more than 300 million pounds annually and may be particularly important in providing fishing in those areas where there is a deficiency of inland opportunities.

Water quality problems frequently are even more critical than supply problems and often are the limiting factor. This is particularly true in the vicinity of densely populated industrial complexes where the greatest demand for recreational resources is found. In addition to various introduced pollutants, waters are frequently subjected to increased temperatures from industrial return waters. The factors noted above will be accentuated by 1980 and 2000 and will require coordinated efforts to conserve fish and wildlife resources.

Wildlife

Wildlife water requirements (table 7) are set out so as to show estimates of actual use. These stated quantities represent the water which will be needed to maintain wetlands vegetation in waters and the maintenance of wetlands of significance to wildlife populations. The water-use factor was computed by the U.S. Geological Survey for major types of wetlands vegetation by individual river basins. This factor was applied to the acreage of wetlands in each basin reported in the National Wetlands Inventory conducted by the Fish and Wildlife Service in 1954.

Compared to 1954, it is estimated that demand for waterfowl hunting will increase 75 percent by 1980 and will double by 2000. It is assumed that habitat and water requirements must be expanded

accordingly. This assumption is supported, in a measure, by congressional action which now devotes virtually all funds from duck stamp sales to the location, ascertainment, and acquisition of waterfowl habitat.

COMMERCIAL FISHERIES

A great number of variables are involved in estimating the amount of water required by our commercial fish species, few of which can be adequately evaluated at our present level of knowledge. Consequently, the water requirements for 1954, 1980, and 2000, given in table 8, are provisional estimates based upon rather generalized assumptions.

The estimates of water requirements for inland fresh-water-dependent species were based upon an average annual yield of 20 pounds of fish per acre-foot of water, as determined by G. A. Rounsefell (Copeia, No. 1, 1946, pp. 29–40). The total water requirement for each river basin was calculated by applying this factor to the catch postulated for each of the years under study—1954, 1980, and 2000.

We have no estimates of water requirements for estuaries such as that which Rounsefell determined for inland waters. The problem is further complicated in that important estuarine-dependent fishes, other than shellfish, are mostly temporary residents of the estuaries during critical phases in their lives. We may assume, however, that the amount and quality of fresh water presently flowing into the estuaries would assure the maintenance of existing production levels. The productivity of many estuaries could be improved with present supplies of water if the flow were properly regulated and the quality controlled, and particularly if improved methods of management and cultivation of commercial species were instituted.

Consequently, for estuaries, we have used as our estimate for 1954 and as our requirement for 1980 and 2000 the average annual amount of fresh water supplied to all habitable estuaries. This amount was determined from average annual runoff figures given by the U.S. Geological Survey (Walter B. Langbein, and others, "Annual Runoff in the United States," Geological Survey Circular No. 52, June 1949, 14 pages). Since all runoff does not enter estuarine environments habitable by the species with which we are dealing, a certain amount of subjective evaluation of river systems and shoreline configuration was involved. From these evaluations, made separately for each river basin, it was estimated that a little over 1 billion acre-feet of the total 1.4 billion acre-foot annual runoff enters habitable estuaries.

Direct comparisons of fishery yields and water

TABLE 7. *Estimated water requirements for wildlife and sport fishery resources by major U.S. river basins in 1954, 1980, and 2000*

[In thousands of acre-feet]

Water resource region	Total			Sport fisheries			Wildlife		
	1954	1980	2000	1954	1980	2000	1954	1980	2000
New England	7,394	12,285	15,398	6,900	11,500	14,500	494	785	898
Delaware and Hudson Rivers	10,400	22,100	29,060	9,000	19,600	26,280	1,400	2,500	2,800
Chesapeake Bay	11,969	27,697	38,939	11,000	26,000	37,000	969	1,697	1,939
Eastern Great Lakes	11,951	24,515	33,703	10,800	22,500	31,400	1,151	2,015	2,303
Ohio River	4,690	8,312	11,380	4,500	8,000	11,000	190	312	380
Cumberland River	650	1,087	1,30	600	1,000	1,200	50	87	100
Tennessee River	1,472	3,026	3,645	1,400	2,900	3,500	72	126	145
Southeast	25,500	50,300	60,600	3,000	11,000	15,600	22,500	39,300	45,000
Western Great Lakes	15,227	28,547	39,053	11,200	21,500	31,000	4,027	7,047	8,053
Upper Mississippi River	10,263	19,210	22,925	5,000	10,000	12,400	5,263	9,210	10,525
Lower Mississippi River	11,761	21,157	24,122	1,100	2,500	2,800	10,661	18,657	21,322
Upper Missouri River	24,415	42,826	49,730	4,800	8,500	10,500	19,615	34,326	39,230
Lower Missouri River	1,300	2,000	2,300	1,300	2,000	2,300			
Upper Arkansas-Red Rivers	2,397	4,095	4,894	1,200	2,000	2,500	1,197	2,095	2,394
Lower Arkansas-White-Red Rivers	3,652	5,766	6,404	1,500	2,000	2,100	2,152	3,766	4,304
Western Gulf	15,015	27,400	32,130	900	2,700	3,900	14,115	24,700	28,230
Upper Rio Grande and Pecos Rivers	2,347	4,707	6,394	800	2,000	3,300	1,547	2,707	3,094
Colorado River	3,980	11,691	18,361	3,700	11,200	17,800	280	491	561
Great Basin	6,716	12,878	16,132	900	2,700	4,500	5,816	10,178	11,632
Pacific Northwest	4,029	7,226	10,858	3,500	6,300	9,800	529	926	1,058
Central Pacific	7,567	19,867	30,834	3,700	13,100	23,100	3,867	6,767	7,734
South Pacific	708	2,513	4,115	700	2,500	4,100	8	13	15
Alaska	1,500	2,200	3,000	1,500	2,200	3,000	(1)	(1)	(1)
Hawaii									
Total	184,903	361,405	465,217	89,000	193,700	273,500	95,903	167,705	191,717

[1] Not estimated.

requirements for those basins involving estuaries must be made with caution. For example, species such as menhaden and shrimp migrate from the estuaries which were their nursery grounds, and are caught long distances away. Vessels may land their catches of these species in States not included within the same river basin area as their nursery estuary.

The stated assumptions for inland water requirements indicate an increase in annual fresh water needed for inland commercial fisheries of about 43 million acre-feet. In other words we would need about 2½ times as much water in 2000 as in 1954 for inland commercial fish production. The exact amounts may be open to question because of weaknesses in the basic assumptions, but an increase even approaching this amount would be serious because of the total anticipated increased demand for water.

If action is to be effective in solving the expected water demand problems for commercial fisheries, its initiation should not be delayed. Research and development programs necessary to forestall critical shortages of fishery products cannot be hurried. Ample time for planning and execution must be allowed if they are to be effective. Even more critical may be the great demand for fresh water required to maintain the high productivity of estuaries, which quite apparently will create a serious problem by 2000 regardless of whether our estimates are somewhat high or low.

TABLE 8.—*Estimated water requirements for inland commercial and estuarine fishery resources by major U.S. river basins in 1954, 1980, and 2000*

[In thousands of acre-feet]

Water resource region	Inland commercial			Estuarine [1] all years
	1954	1980	2000	
New England	400	1,100	1,600	18,000
Delaware and Hudson Rivers	400	1,900	2,600	27,000
Chesapeake Bay	2,400	2,900	3,400	50,000
Eastern Great Lakes	1,430	2,500	3,900	.....
Ohio River				
Cumberland River	30	250	500	.....
Tennessee River	1,480	2,000	3,000	.....
Southeast	1,200	1,400	1,600	200,000
Western Great Lakes	2,560	3,900	5,400	.....
Upper Mississippi River	1,400	1,260	1,760	.....
Lower Mississippi River	1,800	2,200	2,500	400,000
Upper Missouri River	120	500	1,000	.....
Lower Missouri River	20	150	330	.....
Upper Arkansas-Red Rivers	20	140	320	.....
Lower Arkansas-White-Red Rivers	760	1,000	3,000	.....
Western Gulf	.....	.....	.....	200,000
Upper Rio Grande and Pecos Rivers	.....	.....	.....	.....
Colorado River	.....	.....	.....	.....
Great Basin	.....	.....	.....	.....
Pacific Northwest	3,660	5,910	8,330	80,000
Central Pacific	530	640	810	20,000
South Pacific	20	30	40	15,000
Alaska	12,700	22,010	33,810	.....
Hawaii	.....	.....	.....	.....
Total	30,930	49,790	73,900	1,010,000

[1] This requirement supports a large and growing marine sport fishery as well as the commercial fishery.

CHAPTER V. PROBLEMS IN ACHIEVING ADEQUATE RECOGNITION FOR FISH AND WILDLIFE IN THE WATER RESOURCES PROGRAM

The major problem in provision of adequate water supplies for fish and wildlife is gaining genuine recognition of the water needs of these resources which will be reflected in law and administrative practices of Federal and State Governments. Each of these governments has many agencies concerned in one way or another with the conservation and use of water. They administer a body of law and related policy which has been built up largely without regard to the needs of fish and wildlife for water.

Because of this, fish and wildlife conservation is not considered as yet a full and equal member of the "select" association of water-use purposes which includes domestic requirements, industry, irrigation, navigation, hydroelectric power, and the provision of flood control, despite the Fish and Wildlife Coordination Act. Because of the materials presented previously in this report, it seems clear that fish and wildlife should be so considered.

Each of these select purposes no doubt was faced with the same problem at some time in the history of water resources policy and law. Aside from development of water resources for domestic and industrial use, the improvement of navigation doubtless was the first field entered by Federal and State Governments in the development of our national water resources. There was probably little opposition to the use of public funds for river and harbor improvements in order to provide transportation facilities for a young and undeveloped nation, even though there were some objections, no doubt, from private canal companies and others who questioned governmental participation in this endeavor.

The acceptance of irrigation as a proper field for governmental effort was arrived at deliberately

and haltingly. The Reclamation Act of 1902 was passed by the Congress after many years of support by the proponents and many years of opposition from those who felt this was not an appropriate field for governmental activities. Flood control was confirmed as a Federal activity only after the disastrous Mississippi floods of 1928, and hydroelectric power, of course, is still far from fully accepted.

Nevertheless these traditional purposes are accepted by members of the Congress, by State legislators, by water resource administrators, and the general public as the real and only true objectives of the water development programs in this country. Any obstacle to the realization of these purposes posed by effects on fish and wildlife resources is frankly considered as strictly incidental by those in control of the Nation's water resources program. Fish and wildlife conservation, as an objective of multiple-purpose water resources development, is in about the same relative position to other resource purposes as irrigation development was in 1899.

In any event, the traditional purposes of water resource development have something approaching a special right in the development of our water resources vis-a-vis fish and wildlife conservation in the policies and attitudes of those who deal with water development. Fish and wildlife resources are invariably asked to step aside so that these other purposes can be accomplished in the name of progress. There is truly a prescriptive emphasis on flood control navigation, power, irrigation, and drainage as the purposes of water development, with fish and wildlife relegated to a strictly ancillary consideration. As soon as the laws, the administrative manuals, and the day-to-day attitudes of people working in the water resources field give full consideration to fulfillment of the needs of fish and wildlife resources for water, a proper balance can be achieved.

FISH AND WILDLIFE COMMAND LESS ECONOMIC POWER

Closely related to this problem is the fact that fish and wildlife resources, on the surface at least, command much less "economic power" than the other products of water resources development. Aside from the products of the commercial fishery and fur, fish and wildlife resources do not represent marketable commodities like kilowatt-hours of hydroelectric energy, like tons of sugar beets produced on irrigated lands, or like percentage increases in real estate values of lands and improvements protected by new flood control works. Each of these, of course, is measurable rather precisely in dollar terms. Fish and wildlife, again excepting commercial fisheries, are, on the other hand, largely values of the mind, the heart, and the spirit, not readily measurable in dollar terms.

There are people who would chart the course of water resource development in this Nation solely by the compass of the dollar sign. They would divide up all the Nation's waters among those who can put them to best use for profit in industry and agriculture. The considerable value in using water and related land resources in part for fish and wildlife conservation depends on the availability of sufficient water, *undivided*, for public use. Nevertheless, the economic pressure of competing demands for the waters of the Nation can overpower the continued existence and welfare of fish and wildlife resources if dollar evaluations are to be a sole criterion for determining how our water resources are to be developed.

EVALUATION OF FISH AND WILDLIFE BENEFITS

A third problem, also closely related, is the evaluation of fish and wildlife benefits under policies and procedures traditionally in use by the Federal water project construction agencies. These policies require that costs for the construction and operation of the several features of a water resources project (involving, of course, an expression in dollar terms and equally reduced to annual equivalents) must be balanced by benefits, also expressed in dollar terms. Here again, there is the problem of integrating the value concepts of fish and wildlife resources, which are basically nonmonetary, into the monetary system of benefit evaluation for marketable products like kilowatt-hours and tons of beets. In the case of irrigation, the evaluation of benefits is a relatively simple matter involving only increased net incomes or lower costs for the producers and users of the commodities of water resources development.

Sportsmen's-expenditure method.—In an attempt to meet this problem, the Fish and Wildlife Service, in evaluating benefits aside from commercial fisheries has relied on the measurement of expected

use by hunters and fishermen of a water resources project, converted to monetary terms by the application of the estimated expenditures of these hunters and fishermen for a variety of goods and services in preparation for use of project facilities. This concept assumes that the public benefits from fishing and hunting represent an amount equal to the expenditure of the sportsmen participants for these goods and services. These expenditures represent, for the business community, increased income as the result of project development which otherwise would not occur. It has been shown previously in this report that hunting and fishing is big business, with expenditures by hunters and fishermen approximating the expenditures of all the households in the United States for electricity. These expenditures are widely distributed among the automobile industry, the oil and gas industry, the sporting arms and fishing tackle industry, and the boating industry, to name only a few. The funds for the profits and wages that are fed into these business activities by fishermen and hunters are every bit as real as the funds fed into the power industry by the expenditures of consumers for electricity. The only difference is that whereas the expenditures of power users are for electric power itself, the expenditures of sportsmen are not for hunting and fishing themselves but for goods and services used in connection with their sports.

Nevertheless, a severe question has been raised with respect to the continued use of the sportsmen's-expenditure method of evaluating benefits in water resource project analysis. An attempt is now, in March 1960, being made to devise an improved method by an interagency water resources group.

Meanwhile, there is strong precedent for continued use of the sportsmen's-expenditure method. At least one large Federal project has been justified by the use of fish and wildlife benefits, so computed, to tip the scales from infeasibility to feasibility. This is the Heyburn Reservoir on Polecat Creek in Oklahoma, a project completed by the Corps of Engineers in 1950 at a cost of $2,374,000. In House Document 290, 80th Congress, on this project, the Board of Engineers for Rivers and Harbors noted that the total measured flood control benefits were somewhat less than the total estimated cost. Then the report of the Board goes on to state:

> The Board also noted that the recreational, fish, and wildlife benefits of $24,700 anticipated from the improvements have been evaluated in part from data obtained from official agencies which are considered authoritative. The Board is therefore of the opinion that such benefits are real, and that their monetary value deserves its proportionate share in the total monetary benefits anticipated.

With the inclusion of these benefits, the total estimated annual costs were slightly exceeded by the estimated annual benefits, and the project was subsequently authorized and constructed.

The adoption of the amendments to the Fish and Wildlife Coordination Act in 1958, giving emphasis to increased effort in joint planning to include fish and wildlife conservation purposes and provide authority for inclusion of fish and wildlife conservation measures in water projects to a greater extent, underscores the necessity for the early development of a sound and generally accepted method for evaluating fish and wildlife benefits. The Federal construction agencies as well as the Fish and Wildlife Service are plainly handicapped in carrying out their responsibilities until this has been accomplished.

ALLOCATION OF PROJECT COSTS TO FISH AND WILDLIFE

Related to the problem of benefit measurement is the problem of allocating project costs to fish and wildlife. Once again, the system of economic analysis which has been built up by water resource agencies includes procedures for allocating costs of multiple-purpose projects to each of the several purposes served by these projects. The essence of the cost allocation procedure is to distribute total project costs among the several purposes so that each purpose will share equitably in any savings due to the economies of multiple-purpose project development.

The system generally accepted for cost allocation is known as the "separable costs-remaining benefits" method. Under this method the separable costs identified with one particular purpose only are allocated to that purpose alone. The remaining joint project costs are then distributed among the various purposes in direct proportion

to their benefits minus their separable costs. If the alternative single purpose project cost for a particular purpose is less than its benefit, then this alternative cost is used in place of the benefit figure in the cost allocation computation. It results in an equitable assignment of separable costs and a share in the cost of facilities which serve all purposes, known as joint costs, to each participating purpose.

In a number of recent cases, t..e measurement of benefits to fish and wildlife and the operation of the cost allocation procedure have resulted in a very substantial share of the costs of certain projects being allocated to fish and wildlife. This again, has raised serious questions in the minds of Members of Congress and others considering project authorization. This question is, no doubt, due largely to imperfections in the method of calculating benefits and allocating costs and to the fact that the fish and wil llife allocations are largely nonreimbursable. But it may also be due to reluctance on the part of those responsible for considering authorization of new water resources projects to accept fish and wildlife conservation as a coequal purpose in the Federal water project program. This is true despite the language of Congress itself in section 1 of the Fish and Wildlife Coordination Act that fish and wildlife conservation "shall receive equal consideration * * * with other features of water resource development programs * * *" and the language of the Fish and Wildilfe Act of 1956 (70 Stat. 1119) declaring the broad national interest in the conservation of fish and wildlife resources.

It has been suggested that cost allocations on these projects to fish and wildlife conservation be limited only to specific costs incurred for separable features serving only this purpose. However, this runs counter to the Fish and Wildlife Coordination Act which provides in section 2(f) for allocation of joint costs to this purpose. Other suggestions have been advanced, in legislation and otherwise, to limit fish and wildlife and other recreational benefits on which cost allocations are based to an arbitrary figure such as $1 per visitor day. This again, is not consistent with the concept of equality of fish and wildlife conservation with other purposes of the Nation's resources program. There is no suggestion to limit evaluated benefits to flood control, for example, to any arbitrary figure established by law. Rather, the evaluations of the Corps of Engineers of benefits in the flood control field are generally accepted by committees of Congress without serious question.

Uniform treatment is also needed in the field of cost allocation. Similar consideration should be afforded the computation of fish and wildlife benefits and cost allocations as is given to computation of, for example, flood control benefits and cost allocations.

REIMBURSEMENT OF FISH AND WILDLIFE COSTS

Reimbursement or cost sharing by interests other than the project construction agency of costs allocated to fish and wildlife conservation on Federal water projects is another problem that needs resolution. There is a strong movement on the part of administrative agencies and the Congress to seek larger financial participation by non-Federal interests in all phases of water resource development. The Federal irrigation program has been based from the beginning on reimbursement by water users of Federal costs, though without interest. The hydroelectric and municipal and industrial water supply phases of the program are reimbursable, with interest. In both cases, beneficiaries are readily identifiable; they produce and sell marketable commodities. It has been stated here that fish and wildlife values created by water resource development do not represent a marketable commodity. Furthermore, the beneficiaries are not easily identifiable. While it is true that those who fish and hunt on project waters and lands can be identified, other beneficiaries such as those who fish in waters downstream from a project reservoir or those who hunt waterfowl which have utilized a reservoir may pursue their sports hundreds of miles away.

The Fish and Wildlife Coordination Act makes provision for reimbursement by non-Federal interests of costs allocated to fish and wildlife conservation on a finding of the construction agencies which is approved by the Congress as to the par- of these costs "if any" which should be so reimbursed. The act also provides that all costs "allocated to means and measures to prevent loss of and damage to wildlife resources * * * shall not be reimbursable" on projects authorized to be constructed in accordance vith the Federal reclamation laws.

Practically speaking, the only entities other than

the project construction agency who might conceivably be expected to participate in the costs of a Federal water project on account of fish and wildlife enhancement are the State fish and game departments and commissions and the Fish and Wildlife Service. These State agencies normally have limited budgets, usually restricted to income from sale of hunting and fishing licenses, and funds allocated from Federal excise taxes on sporting arms and ammunition and certain types of fishing equipment as provided for in the Federal Aid to Wildlife and Fish Restoration Acts of 1937 and 1950.

The Fish and Wildlife Service has borne, from funds available to it, part of the costs of project features developed solely for fish and wildlife conservation purposes. The Shiawassee Refuge on the Saginaw River flood control project of the Corps of Engineers, described earlier, is an example where this occurred. However, the Fish and Wildlife Service has never borne any *joint* project costs.

It is to be noted that the operation of specific fish and wildlife installations, like wildlife management areas and fish hatcheries developed wholly for improvement and enhancement, which can conceivably be expected of the Fish and Wildlife Service and State fish and game agencies requires, of course, a considerable expenditure of funds *annually* over the entire life of the project. Also, the construction and installation cost of improvements needed to make project fish and wildlife facilities usable such as buildings, fences, and supplemental water control facilities is likewise substantial. In this case, too, the bearing of these costs can conceivably and reasonably be expected of the Fish and Wildlife Service and the State fish and game agencies, provided again, that the facilities are wholly for the improvement and enhancement of these resources and not for mitigation and compensation of losses.

It should be made clear at this point that there is no question of seeking any reimbursement or cost sharing from non-Federal entities for the cost of providing free and adequate public access to the water areas of Federal reservoirs. By law, this free access "for boating, swimming, bathing, fishing, and other recreational purposes" must be provided by the Corps of Engineers on reservoirs which it builds and operates. This requirement was set forth in section 4 of the Flood Control Act of December 22, 1944 (58 Stat. 887) and restated most recently in section 209 of the Flood Control Act of 1954, approved September 3, 1954 (68 Stat. 1266). The Bureau of Reclamation generally provides similar access to water areas on reservoirs under its control as a matter of policy. Also the Federal Power Commission, pursuant to section 10 of the Federal Power Act (41 Stat. 1068; 49 Stat. 842), normally requires its licensees to allow free public access to water areas of reservoirs. (See also the section next following on "Public Access to Water Projects.")

The Watershed Protection and Flood Prevention Act, appended, provides for cost sharing by the Federal Government of costs allocated to fish and wildlife on small watershed projects constructed under the aegis of the Department of Agriculture. Policies adopted by that Department to implement the act require non-Federal payment of at least 50 percent of the costs so allocated. However, these policies also call for allocation of such costs only on an "incremental" basis—that is only those costs are allocated to fish and wildlife conservation which represent features and facilities added to a project designed otherwise to serve only the flood control and agricultural water management purposes of the project. No joint costs are allocated to fish and wildlife under these policies.

In any event, there is great need for firm establishment of reasonable and practical policies on the question of cost sharing by interests other than the project construction agency of project costs allocated to fish and wildlife enhancement and improvement. These policies should be drawn in such a manner as to permit taking advantage of all opportunities for fish and wildlife improvement that can be justified and to avoid wasting these opportunities by underdeveloping this phase of our natural resources because of rigid and unrealistic reimbursement policies.

PUBLIC ACCESS TO WATER PROJECTS

Public access to Federal project areas for fishing and hunting is essential for realization of the benefits to fish and wildlife which these projects provide. Yet the problem of providing adequate access is a vexing one. Private owners are generally much more loathe to sell their lands to the Federal Government so that public access to Federal reservoir areas can be provided than they

are to sell their lands to the Government for other reservoir project purposes. Here, once again, is evidence of the reluctance to accept fish and wildlife conservation on a comparable basis with flood control, navigation, and the other select purposes of water resource development.

In recent years, land acquisition programs around Federal reservoirs have been sharply curtailed. The policy has been to acquire easements on, rather than fee title to, lands needed for Federal reservoir purposes.

In the case of small watershed projects, public access is the chief deterrent to full realization of fish and wildlife benefits under Federal cost-sharing arrangements. Under the policies of the Department of Agriculture noted above, Federal participation in costs allocated to fish and wildlife conservation is rightly conditioned on provision of public access to the facilities. However, the Federal Government does not acquire any interest whatsoever in the lands utilized for small watershed purposes. This means that the local landowner who permits construction of a reservoir on his land (quite often on the basis of the quid pro quo of having full control of the recreational uses of the reservoir) must permit free public access in order for the group sponsoring the small watershed project to receive Federal financial assistance on account of fish and wildlife benefits. The alternative is for the local sponsoring group itself to acquire the lands in fee or in easement so as to permit public access as a condition to such Federal financial participation. In either case, the proposition has proven to be unattractive to landowners or local project sponsoring groups.

With respect to Federal projects, the Department of the Interior and the Department of the Army developed in 1959 a supplement to their joint land acquisition policy on Federal reservoir projects. This supplement provides in part:

> The public recreational and fish and wildlife potentialities created by water resource development programs and projects constructed with Federal funds should be protected and preserved for the benefit of the general public and the acquisition of such lands as are needed for that purpose shall be recommended to the Congress, to the extent such acquisition is justified by the public benefits which would otherwise be foregone.

The complete reservoir land acquisition policy, including this supplement, is appended to this report.

DRAINAGE OF WETLANDS

The drainage of wetlands under Federal programs of financial and technical asssitance poses one of the most severe of all the problems for fish and wildlife conservation in the water resources field. The term "wetlands" as used here refers to lowlands covered with shallow and sometimes temporary or intermittent waters. They are referred to by such names as marshes, swamps, bogs, wet meadows, potholes, sloughs, river-overflow land, and estuaries.

A wetlands survey, showing the extent, location, type, and value of wetlands for waterfowl, was undertaken by the U.S. Fish and Wildlife Service in cooperation with the conservation departments of the States. The main purpose of this

TABLE 9.—*The value in 1954 of wetlands to waterfowl based on State-unit determinations* [1]

[Values not comparable between States]

[In acres]

State	High	Moderate	Low	Negligible	Total
Alabama	26,500	249,600	1,092,200	230,100	1,598,400
Arizona	16,500	11,400	500		28,400
Arkansas	926,600	699,400	1,496,700	662,700	3,785,400
California	317,800	176,200	57,600	7,700	559,300
Colorado	35,800	101,600	211,900	55,100	404,400
Connecticut	6,900	8,000	4,800	3,700	23,400
Delaware	24,600	40,700	49,600	16,400	131,300
Florida	423,000	1,659,900	6,585,200	8,517,200	17,185,300
Georgia	20,800	440,400	1,428,900	4,029,300	5,919,500
Idaho	59,300	23,100	21,400	5,100	108,900
Illinois	75,700	196,100	112,700	42,800	427,300
Indiana	151,600	68,900	33,600	29,300	283,400
Iowa	57,100	51,600		29,400	138,100
Kansas	120,600	65,900	17,500		204,200
Kentucky	84,400	27,400	34,200	127,100	273,100
Louisiana	706,800	1,706,200	1,092,500	6,141,800	9,647,300
Maine	108,500	52,200	140,300	80,300	[illegible]
Maryland	112,600	87,800	51,100	38,500	290,000
Massachusetts	46,600	55,700	80,200	49,200	231,700
Michigan	310,500	2,713,200	430,100	463,300	3,217,100
Minnesota	1,274,500	478,800	2,991,600		5,044,900
Mississippi	316,200	682,200	854,700	736,300	2,589,400
Missouri	105,700	93,100	74,000	104,100	376,900
Montana	29,100	113,300	45,000		187,400
Nebraska	197,800	171,000	281,000		649,800
Nevada	109,100	70,400	13,000		192,500
New Hampshire	5,700	4,800	1,700	1,300	13,500
New Jersey	127,500	109,100	32,400	900	269,900
New Mexico	24,500	12,900	11,100		48,500
New York	99,800	35,700	55,100	22,200	212,800
North Carolina	81,100	38,500	505,200	3,429,800	4,054,600
North Dakota	554,900	653,600	314,800		1,523,300
Ohio	38,500	12,300	19,300	27,800	97,900
Oklahoma	18,500	133,800	127,400		279,700
Oregon	240,000	76,800	131,900	17,900	472,600
Pennsylvania	8,600	15,100	15,800	13,400	52,900
Rhode Island	1,900	2,100	4,000	17,400	25,400
South Carolina	10,900	194,400	1,495,600	1,676,100	3,377,000
South Dakota	161,400	414,200	176,400		752,000
Tennessee	447,600	128,200	128,600	123,600	828,000
Texas	586,400	1,597,800	923,500	633,300	3,741,000
Utah	249,400	342,100	315,800	267,100	1,174,400
Vermont	6,700	9,500	13,000	8,900	38,100
Virginia	28,300	85,900	177,700	249,200	541,100
Washington	54,300	53,900	68,100	56,900	233,200
West Virginia	1,600		2,200		3,800
Wisconsin	389,500	48,200	2,352,900		2,790,600
Wyoming	11,900	3,500	14,900		30,300
Total	8,819,900	13,616,500	24,087,700	27,915,200	74,439,300

[1] Bureau of Sport Fisheries and Wildlife.

inventory of wetlands was to show the relative importance to waterfowl of the wetlands remaining in each State. The first phase of the job was completed in June 1954. Table 9 shows by States the total number of acres delineated in the inventory according to the four waterfowl habitat-value categories. This represents about 90 percent of the estimated total of 82 million acres of wetlands.

The distribution of the high-quality wetlands used by ducks and geese is indicated on the map of the conterminous United States. A second map shows the distribution of ducks, geese, and coots in the breeding and wintering periods throughout North America rather than just in the United States. This is shown to orient the aelrtive importance of wetlands in the United States to the overall aspects of waterfowl management and its relation to water resources.

The control of wetlands and areas that can be developed for waterfowl habitat is the key to waterfowl preservation and is imperative for production in numbers large enough to permit continued annual harvest. As of January 1, 1957, the Bureau had approximately 3,300,000 acres and the States approximately 1,450,000 acres of suitable waterfowl land. On the basis of existing information, the minimum areas yet to be acquired are about 8 million acres in the conterminous United States of which 3 million acres are in regions of high waterfowl production and the balance on the wintering grounds and along migration routes. Widely distributed lands suitable for this purpose are now available, but opportunity for acquisition and control is rapidly disappearing.

The wetlands of the Nation have value for wildlife as the northern border of the Nation in Maine, Michigan, Wisconsin, and Washington have value for forestry purposes. The wetlands have been exploited and destroyed as wildlife areas as some of the areas in those States have had their forestry values reduced or destroyed by too-fast and unwise exploitation. As previously noted in this report, of the estimated 127 million acres of wetlands that were here at the beginning of the Nation's history, over 80 percent have either been destroyed completely or their wildlife value seriously reduced by the activities of man.

This problem is particularly acute, especially from the waterfowl standpoint, in a 56,000-square-mile area of the northern prairies in Minnesota, North Dakota, and South Dakota. In that section there exists a complex of small temporary and permanent water areas which, taken together, constitute the most valuable area for waterfowl production in the conterminous United States. The Federal Government, under formal international obligations, is responsible for the welfare of waterfowl and other migratory birds in this country. Considerable sums are, of course, spent by the Government, including the Fish and Wildlife Service, in fulfillment of this obligation. At the same time, however, the Federal Government under the laws passed by Congress and administered by the Department of Agriculture, spends considerable sums for financial and technical assistance for agricultural drainage programs which, at least in the prairie pothole section, cancel out a considerable portion of the effectiveness of the Nation's waterfowl conservation program by destruction of these prime waterfowl producing areas. Since 1943, an estimated 1,027,000 acres of this excellent waterfowl producing area has been destroyed by the expenditure by the Federal Government of an estimated $25 million representing the cost of Federal financial and technical assistance for farm drainage in the area.

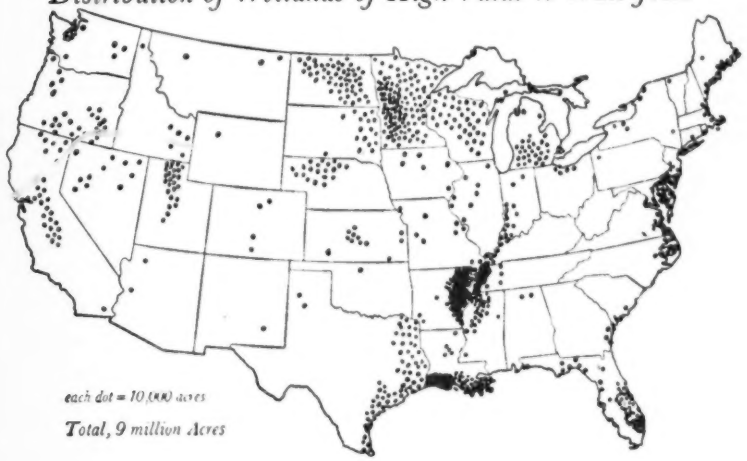
There is no suggestion here about infringing the right of a private landowner to drain his own lands with his own funds. There is, however, considerable question about the efficacy of the Federal Government expending funds, on the one hand, for the conservation of migratory waterfowl and, on the other hand, expending considerable sums in other programs which result in losses to waterfowl conservation and cause increased agricultural production.

This is a clear inconsistency in the Federal water program which will necessitate congressional action if it is to be corrected.

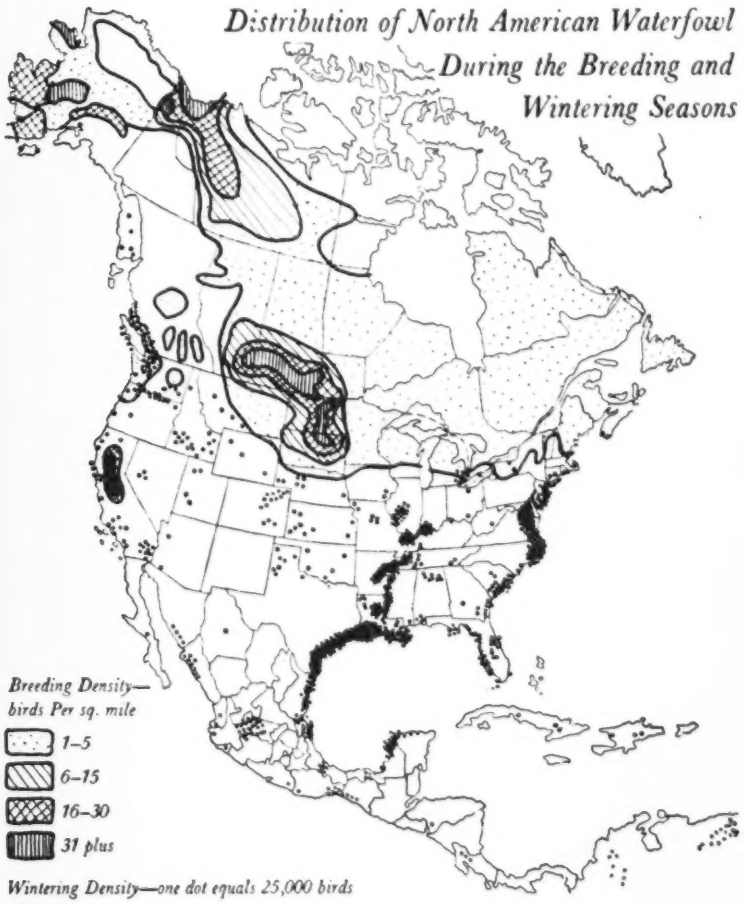
PASSAGE OF ANADROMOUS FISH OVER HIGH DAMS

A problem which is receiving increasing attention in the field of fish and wildlife conservation and water resource development is the conflict between the construction of dams on rivers supporting anadromous fish which has been discussed previously in this report. Anadromous fish are those which spawn in inland streams and rivers, migrate downstream to the sea where they spend most of their adult life, and return to inland rivers and streams to mate, spawn, and continue the life

Distribution of Wetlands of High Value to Waterfowl



Distribution of North American Waterfowl During the Breeding and Wintering Seasons



cycle. Principal species of anadromous fish are salmon of all kinds, steelhead trout, striped bass, and shad.

Dams built on rivers and streams utilized by these fishes in their vital migration from headwater areas to the sea and return, present, of course, an obstacle to the continued existence of this living resource. If anadromous fish cannot surmount these obstacles, they may be forever wiped out.

There has been considerable success in providing for the successful passage of these migrating fish over low-head dams—those with hydraulic heads of 100 feet or less. This passage is accomplished by providing fishways or fish ladders which consist of a series of pools arranged like stair steps so that the adult fish migrating upstream may pass through them from tailwater to forebay by making a series of leaps from one pool level to the next higher. Even with low dams, however, these fishways present complex biological problems and require elaborate and costly devices to provide attraction water so that the fish will find and enter the lowermost end of the ladder.

The juvenile fish migrating downstream back to the sea are able to negotiate low-head dams over spillways, outlet works, and even through draft tubes and low-pressure turbines without overwhelming mortality.

High dams—those with hydraulic heads of 100 feet or more—are another matter. Conventional devices for passage of adults upstream apparently can be utilized successfully for high dams. Recent experiments have shown there is no practical limit on height through which these adult migrating fish can negotiate fishways successfully. At the Bonneville Experiment Station of the Bureau of Commercial Fisheries on the Columbia River in Washington, a blueback salmon ascended an endless fishway to a height of 6,600 feet and was still climbing when the experiment was arbitrarily terminated. However, there are other problems in upstream migration over high dams, involving excessive delay in transit, which are deleterious to the maintenance of the fishery.

The most critical problem, nevertheless, is suitable provision for the fingerlings and juveniles migrating downstream toward the sea. The high pressure in draft tubes and turbines resulting from high hydraulic heads is generally mortal to these young fish. Until this problem is solved, therefore, construction of high dams on rivers utilized by anadromous fish means the end of the race of fish utilizing streams on which the dams are built.

The skimmer device

Considerable effort has been made to solve this problem, but the scale of the effort needs to be greatly increased. A current theory for solution of the problem is the installation of the so-called skimmer device in the forebay of high dams. This device is based on the supposition that juvenile and fingerling anadromous fish will not sound to depths of more than 100 feet in the forebay. Consequently, draft tubes must be placed at this or greater depths so that the young fish will not be drawn into them. (See ch. II for a discussion of a barrier net installed in the forebay in lieu of deep draft tubes.) The skimmer is placed on the surface of the reservoir. The young fish are attracted to the current created by a pumping arrangement in the skimmer; they pass into it and are placed under control. The fish, together with a small amount of water, are then passed over the dam or into a trap from which they are trucked to tailwater level where they are released in the stream below to continue their downstream migration. Most of the water entering the skimmer is pumped back into the reservoir where it can be stored and used for power production or other purposes.

The skimmer device is far from a proven technique as yet. It has been installed in two or three places in 1958 and 1959, but its success even in these few installations can only be demonstrated by observations covering at least two full life cycles of migrating salmon. This will require 8 to 10 years.

The focus of this problem is the Columbia River Basin in the Pacific Northwest. The Columbia River is the principal producer of salmon and other anadromous fish in the continental United States for the commercial fisheries industry. These fish are also the basis for important and growing sport fisheries. The salmon are harvested in both the river system and on the high seas. The problem is also important in California, and is an emerging problem in Alaska, where anadromous fish form the basis for that State's principal industry. The problem is also present on the east coast in connection with the Atlantic salmon of New England and the shad and striped bass of the whole eastern seaboard.

Need for research

As suggested above, however, the problem is presently most acute in the Columbia River Basin, where there are increasingly heavy pressures and demands for the construction of additional high dams. In that basin the efforts of the Federal Government have not yet achieved a solution to this problem in relation to the Federal investment there in dams and reservoirs. There is prime need for greatly increased research effort to find a solution to the fish passage problem.

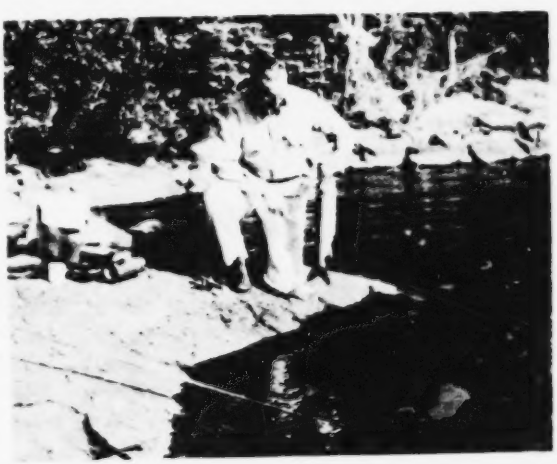
LACK OF RECOGNITION FOR FISH AND WILDLIFE IN STATE WATER LAWS

The lack of recognition for the water needs for fish and wildlife is nowhere more apparent than in the water laws of the States. This has particular significance to the water resource program of the Federal Government in view of the fact that there is growing demand, particularly from the Western States, to subject Federal programs dealing with water resources to State water laws. Indeed, one of these programs—Federal reclamation—has been subject to State water law since its inception more than a half century ago.

State water law generally does not adequately support State responsibilities for the conservation of fish and wildlife resources; it has been noted earlier here that the States have primary jurisdiction over all of these resources except migratory birds. These laws give a very low priority, if any at all, to the water needs of fish and wildlife installations like fish hatcheries and wildlife refuges. These laws are generally oriented toward *dividing* up the waters of streams and lakes among interests who can put these water supplies to various economic uses—the primary purpose of State water law seems to be to divide up the waters of streams and lakes among this industry, that farm, and the other town. The law generally provides that water rights so acquired confer full and unrestricted use of the water, so that the right owners may consume it entirely, pollute it, raise its temperature, or otherwise do with it as they will. This doctrine was considered essential for development of the West. There has been little recognition, however, of the substantial need of the public for water to remain in streams, lakes, and other bodies of water to support fish and wildlife and related outdoor recreational needs. Under State law there can be no right created for fish and wildlife by leaving the water in its natural channel or bed. Indeed, such a right cannot be created for any other purpose.

A thoroughly documented report entitled "Western Water Law and Policy as it Relates to Fish and Wildlife Resources" was presented by Mr. L. C. Binford of Portland, Oreg., a director of the Izaak Walton League of America, at the annual meeting of the Western Association of Game and Fish Commissioners in June 1959. He

The heavy pressure on the Nation's water resources to provide fishing opportunity is represented by this scene near Henley, Mo.



We need to guard against the disappearance of recreational opportunities like these in the high mountain areas in connection with our water resource developments.

stated, after reviewing this survey of western water law, that "Generally speaking, the conclusion is reached that fish and wildlife uses are dependent on the leavings of water." He said that western water law was developed without any consideration for the welfare of fish and wildlife.

There has been some improvement in a few States in this matter in recent years. For example, the Wisconsin Legislature in 1959 passed a bill (126 S.) giving the Wisconsin Conservation Commission veto power in cases of applications for diversion of water from trout streams for purposes of agricultural irrigation. The commission's water policy states that—

> the use of public waters by fish and other wildlife must always in all cases be recognized as a public interest and a natural use equal with any domestic use.

Despite these recent advances in a few States, the need for provision of adequate water for fish and wildlife resources in State law is critical. With the enormously growing demands on water, which will have to be regulated largely under state law, there will have to be a much more widespread recognition of fish and wildlife needs in State water law if these resources are to survive.

RESEARCH IN RESERVOIR MANAGEMENT

There is also a problem in this field of water development which urgently needs solution by research in reservoir fish and wildlife management. It has been noted that thousands of reservoirs which have been constructed in the Nation have altered the fish and wildlife habitat characteristics of many hundreds of thousands of miles of the Nation's streams and bottomlands. Many of these reservoirs have greatly increased the fishery resource and fishing opportunities. Many others have had the opposite effect. Far too little is known about what causes the difference.

Also, reservoirs and surrounding project lands have provided, in some cases, improved conditions for waterfowl, fur bearers, and other aquatic birds and mammals. Efforts should be made to provide for these resources through plantings, water level control, and other management techniques. At the same time, upland game habitat that is destroyed through reservoir construction should, to the extent possible, be created elsewhere.

There have been conscientious attempts by the Fish and Wildlife Service, the State fish and game agencies, and others, to develop plans for reservoir construction and operation which will maximize the natural production of fish and game in and adjacent to the reservoirs. These have been only partially successful and the need for research in the development of better management techniques is obvious. Typically, a new reservoir will provide an outstanding fishery for a few years immediately following first impoundment. Then the quality of the fishery declines as the reservoir gains a steadily increasing population of rough fish like carp and suckers and a steadily decreasing yield of fishes desired by sportsmen and commercial interests.

In view of the increasing demand for fishing opportunities and the growing number of new reservoirs which will be required to keep pace with the Nation's needs for water and water control, it is obviously in the public interest to develop, through research, a fund of new basic knowledge about fish populations and special habitat features found within reservoirs. This will provide a basis for use by the States, who have primary responsibility in this matter, for developing new management techniques needed to assure future good fishing in all or nearly all reservoirs.

ESTUARINE RESEARCH

The importance of estuaries and shallows around the Nation's coastlines to fish and wildlife has been discussed in this report. So, too, has the increased number of Federal and other projects which are having tremendous effects on this estuarine environment.

Unfortunately, little is known about the characteristics of estuaries which make them so productive. Consequently, fish and wildlife conservation agencies are unable to develop plans and recommendations which can be provided to project agencies for conservation of these resources in time to assure preservation of these high values.

The need for research to develop a basis for

management is particularly important with respect to estuaries. Research is needed to supply knowledge pertaining to estuaries and their fish and wildlife resources, in three primary fields:

(1) On the physical and chemical characteristics of coastal waters. This includes a knowledge of currents, the effects of floodwaters, impoundment, ditching, diking, and channeling on water movements and water quality;

(2) On biological facts and relationships. This includes food chains, life cycles, predator-host relations, requirements of individual species to live and reproduce, and growth of aquatic plants; and

(3) On human relationships. More people will in the years to come seek recreation, their livelihood, and a place to live on or close to the coast. Man's use must be compatible with the survival of the aquatic resources if his occupancy of these areas is to remain successful. Conflicts are certain, but knowledge gained through research can prevent many irreparable mistakes as well as show the way for greater use and enjoyment of what is available on an equitable basis.

APPENDIXES

Appendix A

Fish and Wildlife Coordination Act[1]

The following compilation of provisions of the Fish and Wildlife Coordination Act has been prepared for convenient reference:

Sec. 1. For the purpose of recognizing the vital contribution of our wildlife resources to the Nation, the increasing public interest and significance thereof due to expansion of our national economy and other factors, and to provide that wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs through the effectual and harmonious planning, development, maintenance, and coordination of wildlife conservation and rehabilitation for the purposes of this Act in the United States, its Territories and possessions, the Secretary of the Interior is authorized (1) to provide assistance to, and cooperate with, Federal, State, and public or private agencies and organizations in the development, protection, rearing, and stocking of all species of wildlife, resources thereof, and their habitat, in controlling losses of the same from disease or other causes, in minimizing damages from overabundant species, in providing public shooting and fishing areas, including easements across public lands for access thereto, and in carrying out other measures necessary to effectuate the purposes of this Act; (2) to make surveys and investigations of the wildlife of the public domain, including lands and waters or interests therein acquired or controlled by any agency of the United States; and (3) to accept donations of land and contributions of funds in furtherance of the purposes of this Act.

Sec. 2 (a) Except as hereafter stated in subsection (b) of this section, whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever, including navigation and drainage, by any department or agency of the United States, or by any public or private agency under Federal permit or license, such department or agency first shall consult with the United States Fish and Wildlife Service, Department of the Interior, and with the head of the agency exercising administration over the wildlife resources of the particular State wherein the impoundment, diversion, or other control facility is to be constructed, with a view to the conservation of wildlife resources by preventing loss of and damage to such resources as well as providing for the development and improvement thereof in connection with such water-resource development.

(b) In furtherance of such purposes, the reports and recommendations of the Secretary of the Interior on the wildlife aspects of such projects, and any report of the head of the State agency exercising administration over the wildlife resources of the State, based on surveys and investigations conducted by the United States Fish and Wildlife Service and such State agency for the purpose of determining the possible damage to wildlife resources and for the purpose of determining means and measures that should be adopted to prevent the loss of or damage to such wildlife resources, as well as to provide concurrently for the development and improvement of such resources, shall be made an integral part of any report prepared or submitted by any agency of the Federal Government responsible for engineering surveys and construction of such projects when such reports are presented to the Congress or to any agency or person having the authority or the power, by administrative action or otherwise, (1) to authorize the construction of water-resource development projects or (2) to approve a report on the modification or supplementation of plans for previously authorized projects, to which this Act applies. Recommendations of the Secretary of the Interior shall be as specific as is practicable with respect to features recommended for wildlife conservation and development, lands to be utilized or acquired for such purposes, the results expected, and shall describe the damage to wildlife attributable to the project and the measures proposed for mitigating or compensating for these damages. The reporting officers in project reports of the Federal agencies shall give full consideration to the report and recommendations of the Secretary of the Interior and to any report of the State agency on the wildlife aspects of such projects, and the project plan shall include such justifiable means and measures for wildlife purposes as the reporting agency finds should be adopted to obtain maximum overall project benefits.

(c) Federal agencies authorized to construct or operate water-control projects are hereby authorized to modify or add to the structures and operations of such projects, the construction of which has not been substantially completed on the date of enactment of the Fish and Wildlife Coordination Act, and to acquire lands in accordance with section 3 of this Act, in order to accommodate the means

[1] The act of Mar. 10, 1934, 48 Stat. 401, as amended by the act of Aug. 14, 1946, 60 Stat. 1080; the act of June 19, 1948, 62 Stat. 497; and the act of Aug. 12, 1958, 72 Stat. 563; 16 U.S.C. 661 et seq.

The latest revision (act of Aug. 12, 1958) establishes the official title of this legislation as the "Fish and Wildlife Coordination Act"; it also revised the first four sections of the legislation and contains an authorization for appropriations.

Preceding page blank

and measures for such conservation of wildlife resources as an integral part of such projects: *Provided*, That for projects authorized by a specific Act of Congress before the date of enactment of the Fish and Wildlife Coordination Act (1) such modification or land acquisition shall be compatible with the purposes for which the project was authorized; (2) the cost of such modifications or land acquisition, as means and measures to prevent loss of and damage to wildlife resources to the extent justifiable, shall be an integral part of the cost of such projects; and (3) the cost of such modifications or land acquisition for the development or improvement of wildlife resources may be included to the extent justifiable, and an appropriate share of the cost of any project may be allocated for this purpose with a finding as to the part of such allocated cost, if any, to be reimbursed by non-Federal interests.

(d) The cost of planning for and the construction or installation and maintenance of such means and measures adopted to carry out the conservation purposes of this section shall constitute an integral part of the cost of such projects: *Provided*, That such cost attributable to the development and improvement of wildlife shall not extend beyond those necessary for (1) land acquisition, (2) modification of the project, and (3) modification of project operations; but shall not include the operation of wildlife facilities nor the construction of such facilities beyond those herein described: *And provided further*, That, in the case of projects authorized to be constructed, operated, and maintained in accordance with the Federal reclamation laws (Act of June 17, 1902, 32 Stat. 388, and Acts amendatory thereof or supplementary thereto), the Secretary of the Interior, in addition to allocations made under section 9 of the Reclamation Project Act of 1939 (53 Stat. 1187), shall make findings on the part of the estimated cost of the project which can properly be allocated to means and measures to prevent loss of and damage to wildlife resources, which costs shall not be reimbursable, and an appropriate share of the project costs may be allocated to development and improvement of wildlife resources, with a finding as to the part of such allocated costs, if any, to be reimbursed by non-Federal fish and wildlife agencies or interests.

(e) In the case of construction by a Federal agency, that agency is authorized to transfer to the United States Fish and Wildlife Service, out of appropriations or other funds made available for investigations, engineering, or construction, such funds as may be necessary to conduct all or part of the investigations required to carry out the purposes of this section.

(f) In addition to other requirements, there shall be included in any report submitted to Congress supporting a recommendation for authorization of any new project for the control or use of water as described herein (including any new division of such project or new supplemental works on such project) an estimation of the wildlife benefits or losses to be derived therefrom including benefits to be derived from measures recommended specifically for the development and improvement of wildlife resources, the cost of providing wildlife benefits (including the cost of additional facilities to be installed or lands to be acquired specifically for that particular phase of wildlife conservation relating to the development and improvement of wildlife), the part of the cost of joint-use facilities allocated to wildlife, and the part of such costs, if any, to be reimbursed by non-Federal interests.

(g) The provisions of this section shall be applicable with respect to any project for the control or use of water as prescribed herein, or any unit of such project authorized before or after the date of enactment of the Fish and Wildlife Coordination Act for planning or construction, but shall not be applicable to any project or unit thereof authorized before the date of enactment of the Fish and Wildlife Coordination Act if the construction of the particular project or unit thereof has been substantially completed. A project or unit thereof shall be considered to be substantially completed when sixty percent or more of the estimated construction cost has been obligated for expenditure.

(h) The provisions of this Act shall not be applicable to those projects for the impoundment of water where the maximum surface area of such impoundments is less than ten acres, nor to activities for or in connection with programs primarily for land management and use carried out by Federal agencies with respect to Federal lands under their jurisdiction.

SEC. 3. (a) Subject to the exceptions prescribed in section 2(h) of this Act, whenever the waters of any stream or other body of water are impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever, including navigation and drainage, by any department or agency of the United States, adequate provision, consistent with the primary purposes of such impoundment, diversion, or other control, shall be made for the use thereof, together with any areas of land, water, or interests therein, acquired or administered by a Federal agency, in connection therewith, for the conservation, maintenance, and management of wildlife resources thereof, and its habitat thereon, including the development and improvement of such wildlife resources pursuant to the provisions of section 2 of this Act.

(b) The use of such waters, land, or interests therein for wildlife conservation purposes shall be in accordance with general plans approved jointly (1) by the head of the particular department or agency exercising primary administration in each instance, (2) by the Secretary of the Interior, and (3) by the head of the agency exercising the administration of the wildlife resources of the particular State wherein the waters and areas lie. Such waters and other interests shall be made available, without cost for administration, by such State agency, if the management of the properties relate to the conservation of wildlife other than migratory birds, or by the Secretary of the Interior, for administration in such manner as he may deem advisable, where the particular properties have value in carrying out the national migratory bird management program: *Provided*, That nothing in this section shall be construed as affecting the authority of the Secretary of Agriculture to cooperate with the States or in making

lands available to the States with respect to the management of wildlife and wildlife habitat on lands administered by him.

(c) When consistent with the purposes of this Act and the reports and findings of the Secretary of the Interior prepared in accordance with section 2, land, waters, and interests therein may be acquired by Federal construction agencies for the wildlife conservation and development purposes of this Act in connection with a project as reasonably needed to preserve and assure for the public benefit the wildlife potentials of the particular project area: *Provided*, That before properties are acquired for this purpose, the probable extent of such acquisition shall be set forth, along with other data necessary for project authorization, in a report submitted to the Congress, or in the case of a project previously authorized, no such properties shall be acquired unless specifically authorized by Congress, if specific authority for such acquisition is recommended by the construction agency.

(d) Properties acquired for the purposes of this section shall continue to be used for such purposes, and shall not become the subject of exchange or other transactions if such exchange or other transaction would defeat the initial purpose of their acquisition.

(e) Federal lands acquired or withdrawn for Federal water-resource purposes and made available to the States or to the Secretary of the Interior for wildlife management purposes, shall be made available for such purposes in accordance with this Act, notwithstanding other provisions of law.

(f) Any lands acquired pursuant to this section by any Federal agency within the exterior boundaries of a national forest shall, upon acquisition, be added to and become national forest lands, and shall be administered as a part of the forest within which they are situated, subject to all laws applicable to lands acquired under the provisions of the Act of March 1, 1911 (36 Stat. 961), unless such lands are acquired to carry out the National Migratory Bird Management Program.

SEC. 4. Such areas as are made available to the Secretary of the Interior for the purposes of this Act, pursuant to sections 1 and 3 or pursuant to any other authorization, shall be administered by him directly or in accordance with cooperative agreements entered into pursuant to the provisions of the first section of this Act and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon, as may be adopted by the Secretary in accordance with general plans approved jointly by the Secretary of the Interior and the head of the department or agency exercising primary administration of such areas: *Provided*, That such rules and regulations shall not be inconsistent with the laws for the protection of fish and game of the States in which such area is situated (16 U.S.C., sec. 664): *Provided further*, That lands having value to the National Migratory Bird Management Program may, pursuant to general plans, be made available without cost directly to the State agency having control over wildlife resources, if it is jointly determined by the Secretary of the Interior and such State agency that this would be in the public interest: *And provided further*, That the Secretary of the Interior shall have the right to assume the management and administration of such lands in behalf of the National Migratory Bird Management Program if the Secretary finds that the State agency has withdrawn from or otherwise relinquished such management and administration.

SEC. 5. The Secretary of the Interior, through the Fish and Wildlife Service and the Bureau of Mines, is authorized to make such investigations as he deems necessary to determine the effects of domestic sewage, mine, petroleum, and industrial wastes, erosion silt, and other polluting substances on wildlife, and to make reports to the Congress concerning such investigations and of recommendations for alleviating dangerous and undesirable effects of such pollution. These investigations shall include (1) the determination of standards of water quality for the maintenance of wildlife; (2) the study of methods of abating and preventing pollution, including methods for the recovery of useful or marketable products and byproducts of wastes; and (3) the collation and distribution of data on the progress and results of such investigations for the use of Federal, State, municipal, and private agencies, individuals, organizations, or enterprises.

SEC. 5A. In the management of existing facilities (including locks, dams, and pools) in the Mississippi River between Rock Island, Illinois, and Minneapolis, Minnesota, administered by the United States Corps of Engineers of the Department of the Army, that Department is hereby directed to give full consideration and recognition to the needs of fish and other wildlife resources and their habitat dependent on such waters, without increasing additional liability to the Government, and, to the maximum extent possible without causing damage to levee and drainage districts, adjacent railroads and highways, farm lands, and dam structures, shall generally operate and maintain pool levels as though navigation was carried on throughout the year.

SEC. 6. There is authorized to be appropriated from time to time, out of any money in the Treasury not otherwise appropriated, such amounts as may be necessary to carry out the provisions of this Act and regulations made pursuant thereto, including the construction of such facilities, buildings, and other improvements necessary for economical administration of areas made available to the Secretary of the Interior under this Act, and the employment in the city of Washington and elsewhere of such persons and means as the Secretary of the Interior may deem necessary for such purposes.

SEC. 7. Any person who shall violate any rule or regulation promulgated in accordance with this Act shall be guilty of a misdemeanor and upon conviction thereof shall be fined not more than $500 or imprisoned for not more than one year, or both.

SEC. 8. The terms "wildlife" and "wildlife resources" as used herein include birds, fishes, mammals, and all other classes of wild animals and all types of aquatic and land vegetation upon which wildlife is dependent.

SEC. 9. The provisions of this Act shall not apply to the Tennessee Valley Authority.

Appendix B. Watershed Protection and Flood Prevention Act, as Amended [1]

AN ACT To authorize the Secretary of Agriculture to cooperate with States and local agencies in the planning and carrying out of works of improvement for soil conservation, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That erosion, floodwater, and sediment damages in the watersheds of the rivers and streams of the United States, causing loss of life and damage to property, constitute a menace to the national welfare; and that it is the sense of Congress that the Federal Government should cooperate with States and their political subdivisions, soil or water conservation districts, flood prevention or control districts, and other local public agencies for the purpose of preventing such damages and of furthering the conservation development, utilization, and disposal of water and thereby of preserving and protecting the Nation's land and water resources.

Sec. 2. For the purposes of this Act, the following terms shall mean:

The "Secretary"—the Secretary of Agriculture of the United States.

"Works of improvement"—any undertaking for—

(1) flood prevention (including structural and land-treatment measures) or

(2) the conservation, development, utilization and disposal of water

in watershed or subwatershed areas not exceeding two hundred and fifty thousand acres and not including any single structure which provides more than five thousand acre-feet of floodwater detention capacity, and more than twenty-five thousand acre-feet of total capacity. No appropriation shall be made for any plan involving an estimated Federal contribution to construction costs in excess of $250,000, or which includes any structure which provides more than twenty-five hundred acre-feet of total capacity unless such plan has been approved by resolutions adopted by the appropriate committees of the Senate and House of Representatives: *Provided*, That in the case of any plan involving no single structure providing more than 4,000 acre-feet of total capacity the appropriate committees shall be the Committee on Agriculture and Forestry of the Senate and the Committee on Agriculture of the House of Representatives and in the case of any plan involving any single structure of more than 4,000 acre-feet of total capacity the appropriate committees shall be the Committee on Public Works of the Senate and the Committee on Public Works of the House of Representatives, respectively. A number of such subwatersheds when they are component parts of a larger watershed may be planned together when the local sponsoring organizations so desire.

"Local organization"—any State, political subdivision thereof, soil or water conservation district, flood prevention or control district, or combinations thereof, or any other agency having authority under State law to carry out, maintain and operate the works of improvement.

Sec. 3. In order to assist local organizations in preparing and carrying out plans for works of improvement, the Secretary is authorized, upon application of local organizations if such application has been submitted to, and not disapproved within 45 days by, the State agency having supervisory responsibility over programs provided for in this Act, or by the Governor if there is no State agency having such responsibility—

(1) to conduct such investigations and surveys as may be necessary to prepare plans for works of improvement;

(2) to prepare plans and estimates required for adequate engineering evaluation;

(3) to make allocations of costs to the various purposes to show the basis of such allocations and to determine whether benefits exceed costs;

(4) to cooperate and enter into agreements with and to furnish financial and other assistance to local organizations: *Provided*, That, for the land-treatment measures, the Federal assistance shall not exceed the rate of assistance for similar practices under existing national programs;

(5) to obtain the cooperation and assistance of other Federal agencies in carrying out the purposes of this section.

Sec. 4. The Secretary shall require as a condition to providing Federal assistance for the installation of works of improvement that local organizations shall—

(1) acquire without cost to the Federal Government such land, easements, or rights-of-way as will be needed in connection with works of improvement installed with Federal assistance;

(2) assume (A) such proportionate share, as is determined by the Secretary to be equitable in consideration of the direct identifiable benefits, of the costs of installing any works of improvement, involving Federal assistance, which is applicable to the agricultural phases of the conservation, development, utilization, and disposal of water or for fish and wildlife development, and (B) all of the cost of installing any portion of such works applicable to other purposes except that any part of the construction cost (including engineering costs) applicable to flood prevention and features relating thereto shall be borne by the Federal Government and paid for by the Secretary out of funds appropriated for the purposes of this Act;

(3) make arrangements satisfactory to the Secretary for defraying costs of operating and maintaining such works of improvement, in accordance with regulations presented by the Secretary of Agriculture;

(4) acquire, or provide assurance that landowners or water users have acquired, such water rights, pursuant to State law, as may be needed in the installation and operation of the work of improvement;

(5) obtain agreements to carry out recommended soil conservation measures and proper farm plans from owners of not less than 50 per centum of the lands situated in the drainage area above each retention

[1] Public Law 566, 83d Cong., 68 Stat. 666; Public Law 1018, 84th Cong., 70 Stat. 1088; Public Law 85-624, 85th Cong., 72 Stat. 563; Public Law 85-865, 85th Cong., 72 Stat. 1605.

reservoir to be installed with Federal assistance; and

(6) submit a plan of repayment satisfactory to the Secretary for any loan or advancement made under the provisions of section 8.

SEC. 5. At such time as the Secretary and the interested local organization have agreed on a plan for works of improvement, and the Secretary has determined that the benefits exceed the costs, and the local organization has met the requirements for participation in carrying out the works of improvement as set forth in section 4, the local organization with such assistance as it may request from the Secretary, which assistance the Secretary is hereby authorized to give, shall secure engineering and other services, including the design, preparation of contracts and specifications, awarding of contracts, and supervision of construction, in connection with such works of improvement, and in order to properly carry out such services in such projects as to such structures therein providing for municipal or industrial water supplies, the local organization shall, and in such projects not providing for municipal or industrial water supplies, the local organization may, retain or employ a professional engineer or engineers satisfactory to the Secretary, and the Secretary shall reimburse the local organization for the cost it may incur for the services of such engineer or engineers as is properly chargeable to such works of improvement, except that if the local organization decides not to retain or employ a professional engineer or if the Secretary determines that competent engineering service are not available he may contract for a competent engineer to provide such services or arrange for employees of the Federal Government to provide such services: *Provided*, That at the request of the local organization which retains or employs a professional engineer or engineers as aforesaid, the Secretary may advance such amounts as may be necessary to pay for such services, but such advances with respect to any works of improvement shall not exceed 5 per centum of the estimated total cost of such works: *Provided further*, That, except as to the installation of works of improvement on Federal lands, the Secretary shall not construct or enter into any contract for the construction of any structure unless there is no local organization authorized by State law to undertake such construction or to enter into such contract, and in no event after July 1, 1956: *Provided*, That in participating in the installation of such works of improvement the Secretary, as far as practicable and consistent with his responsibilities for administering the overall national agricultural program, shall utilize the authority conferred upon him by the provisions of this Act: *Provided further*, That whenever the estimated Federal contribution to the construction cost of works of improvement in any watershed or subwatershed area shall exceed $250,000 or the works of improvement include any structure having a total capacity in excess of twenty-five hundred acre-feet, the Secretary shall transmit a copy of the plan and the justification therefor to the Congress through the President: *Provided further*, That any such plan involving an estimated Federal contribution to construction costs in excess of $250,000 or containing any structure having a total capacity in excess of twenty-five hundred acre-feet (a) which includes reclamation or irrigation works or which affects public or other lands or wildlife under the jurisdiction of the Secretary of the Interior, or (b) which includes Federal assistance for floodwater detention structures, shall be submitted to the Secretary of the Interior or the Secretary of the Army, respectively, for his views and recommendations at least thirty days prior to transmission of the plan to the Congress through the President. The views and recommendations of the Secretary of the Interior, and the Secretary of the Army, if received by the Secretary of Agriculture prior to the expiration of the above thirty-day period, shall accompany the plan transmitted by the Secretary of Agriculture to the Congress through the President: *Provided further*, That, prior to any Federal participation in the works improvement under this Act, the President shall issue such rules and regulations as he deems necessary or desirable to carry out the purposes of this Act, and to assure the coordination of the work authorized under this Act and related work of other agencies including the Department of the Interior and the Department of the Army.

SEC. 6. The Secretary is authorized to cooperate with other Federal and with States and local agencies to make investigations and surveys of the watersheds of rivers and other waterways as a basis for the development of coordinated programs. In areas where the programs of the Secretary of Agriculture may affect public or other lands under the jurisdiction of the Secretary of the Interior, the Secretary of the Interior is authorized to cooperate with the Secretary of Agriculture in the planning and development of works or programs for such lands.

SEC. 7. The provisions of the Act of June 22, 1936 (49 Stat. 1570), as amended and supplemented, conferring authority upon the Department of Agriculture under the direction of the Secretary of Agriculture to make preliminary examinations and surveys and to prosecute works of improvement for runoff and waterflow retardation and soil erosion prevention on the watersheds of rivers and other waterways are hereby repealed: *Provided*, That (a) the authority of that Department of Agriculture, under the direction of the Secretary, to prosecute the works of improvement for runoff and waterflow retardation and soil erosion prevention authorized to be carried out by the Department by the Act of December 22, 1944 (58 Stat. 887), as amended, and (b) the authority of the Secretary of Agriculture to undertake emergency measures for runoff retardation and soil erosion prevention authorized to be carried out by section 7 of the Act of June 28, 1938 (52 Stat. 1215), as amended by section 216 of the Act of May 17, 1950 (64 Stat. 163), shall not be affected by the provisions of this section.

SEC. 8. The Secretary is authorized to make loans or advancements to local organizations to finance the local share of costs of carrying out works of improvement provided for in this Act. Such loans or advancements shall be made under contracts or agreements which will provide, under such terms and conditions as the Secretary deems appropriate, for the repayment thereof in not more than fifty years from the date when the principal benefits of the works of improvement first become available, with interest at the average rate, as determined by the Secretary of the Treasury, payable by the Treasury upon its marketable public obligations outstanding at the beginning of the fiscal

year in which the loan or advancement is made, which are neither due nor callable for redemption for fifteen years from date of issue. With respect to any single plan for works of improvement, the amount of any such loan or advancement shall not exceed five million dollars.

SEC. 9. The provisions of this Act shall be applicable to Hawaii, Alaska, Puerto Rico, and the Virgin Islands.

SEC. 10. There are hereby authorized to be appropriated such sums as may be necessary to carry out the purposes of this Act, such sums to remain available until expended.

SEC. 11. This Act may be cited as the "Watershed Protection and Flood Prevention Act".

SEC. 12. When the Secretary approves the furnishing of assistance to a local organization in preparing a plan for works of improvement as provided for in section 3:

(1) The Secretary shall so notify the Secretary of the Interior in order that the latter, as he desires, may make surveys and investigations and prepare a report with recommendations concerning the conservation and development of wildlife resources and participate, under arrangements satisfactory to the Secretary of Agriculture, in the preparation of a plan for works of improvement that is acceptable to the local organization and the Secretary of Agriculture.

(2) Full consideration shall be given to the recommendations contained in any such report of the Secretary of the Interior as he may submit to the Secretary of Agriculture prior to the time the local organization and the Secretary of Agriculture have agreed on a plan for works of improvement. The plan shall include such of the technically and economically feasible works of improvement for wildlife purposes recommended in the report by the Secretary of the Interior as are acceptable to, and agreed to by, the local organization and the Secretary of Agriculture, and such report of the Secretary of the Interior shall, if requested by the Secretary of the Interior, accompany the plan for works of improvement when it is submitted to the Secretary of Agriculture for approval or transmitted to the Congress through the President.

(3) The cost of making surveys and investigations and of preparing reports concerning the conservation and development of wildlife resources shall be borne by the Secretary of the Interior out of funds appropriated to his Department. * * *

Public Law 85-624, approved August 12, 1958, which amends both the Fish and Wildlife Coordination Act and the Watershed Protection and Flood Prevention Act, contains a concluding section reading as follows:

SEC. 4. There is authorized to be appropriated and expended such funds as may be necessary to carry out the purposes of this Act.

APPENDIX C

FISH AND WILDLIFE ACT OF 1956, AS AMENDED[1]

AN ACT To establish a sound and comprehensive national policy with respect to fish and wildlife; to strengthen the fish and wildlife segments of the national economy; to establish within the Department of the Interior the position of Assistant Secretary for Fish and Wildlife; to establish a United States Fish and Wildlife Service; and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Fish and Wildlife Act of 1956".

DECLARATION OF POLICY

SEC. 2. The Congress hereby declares that the fish, shellfish, and wildlife resources of the Nation make a material contribution to our national economy and food supply, as well as a material contribution to the health, recreation, and well-being of our citizens; that such resources are a living, renewable form of national wealth that is capable of being maintained and greatly increased with proper management, but equally capable of destruction if neglected or unwisely exploited; that such resources afford outdoor recreation throughout the Nation and provide employment directly or indirectly, to a substantial number of citizens; that the fishing industries strengthen the defense of the United States through the provision of a trained seafaring citizenry and action-ready fleets of seaworthy vessels; that the training and sport afforded by fish and wildlife resources strengthen the national defense by contributing to the general health and physical fitness of millions of citizens; and that properly developed, such fish and wildlife resources are capable of steadily increasing these valuable contributions to the life of the Nation.

The Congress further declares that the fishing industry, in its several branches, can prosper and thus fulfill its proper function in national life only if certain fundamental needs are satisfied by means that are consistent with the public interest and in accord with constitutional functions of governments. Among these needs are:

(1) Freedom of enterprise—freedom to develop new areas, methods, products, and markets in accordance with sound economic principles, as well as freedom from unnecessary administrative or legal restrictions that unreasonably conflict with or ignore economic needs.

(2) Protection of opportunity—maintenance of an economic atmosphere in which domestic production and processing can prosper; protection from subsidized competing products; protection of opportunity to fish on the high seas in accordance with international law;

(3) Assistance—assistance consistent with that provided by the Government for industry generally, such as is involved in promoting good industrial relations, fair trade standards, harmonious labor relations, better health standards and sanitation; and including, but not limited to—

(a) services to provide current information on production and trade, market promotion and development, and an extension service,

[1] Public Law 1024, 84th Cong., 70 Stat. 1119; Public Law 808, 85th Cong., 72 Stat. 1710. Basic act approved Aug. 8, 1956.

(b) research services for economic and technologic development and resource conservation, and

(c) resource management to assure the maximum sustainable production for the fisheries.

The Congress further declares that the provisions of this Act are necessary in order to accomplish the objective of proper resource development, and that this Act shall be administered with due regard to the inherent right of every citizen and resident of the United States to engage in fishing for his own pleasure, enjoyment, and betterment, and with the intent of maintaining and increasing the public opportunities for recreational use of our fish and wildlife resources, and stimulating the development of a strong, prosperous, and thriving fishery and fish processing industry.

REORGANIZATION WITHIN THE DEPARTMENT OF THE INTERIOR

SEC. 3. (a) There is hereby established within the Department of the Interior the position of Assistant Secretary for Fish and Wildlife, and the position of Commissioner of Fish and Wildlife. Such Assistant Secretary shall be appointed by the President, by and with the advice and consent of the Senate, and shall be compensated at the same rate as other Assistant Secretaries. The Commissioner shall be appointed by the President by and with the advice and consent of the Senate. He shall receive compensation at the same rate as that provided for Grade GS–18. There is also established a United States Fish and Wildlife Service within the Department, consisting of two separate agencies, each of which shall have the status of a Federal bureau. There shall be a Director of each of said Bureaus appointed by the Secretary at Grades GS–17 each. One of the agencies shall be known as the "Bureau of Commercial Fisheries" and the other agency shall be known as the "Bureau of Sport Fisheries and Wildlife." The United States Fish and Wildlife Service, except as prescribed by this Act, shall succeed to and replace the presently existing Fish and Wildlife Service of the Department.

(b) The functions of the United States Fish and Wildlife Service hereby established shall be administered under the supervision of the said Commissioner of Fish and Wildlife, who shall be subject to the supervision of the Assistant Secretary for Fish and Wildlife.

(c) All functions and responsibilities placed in the Department of the Interior or any official thereof by this Act shall be included among the functions and responsibilities of the Secretary of the Interior, as the head of the Department, and shall be carried out under his direction pursuant to such procedures or delegations of authority as he may deem advisable and in the public interest.

(d) In order to make a proper distribution between the two Bureaus of the United States Fish and Wildlife Service established by this Act, the previously existing functions, powers, duties, authority, liabilities, commitments, personnel, records, and other properties or matters previously handled by or administered through the former Fish and Wildlife Service of the Department, shall be distributed as follows:

(1) The Bureau of Commercial Fisheries shall be responsible for those matters to which this Act applies relating primarily to commercial fisheries, whales, seals, and sea-lions, and related matters;

(2) The Bureau of Sport Fisheries and Wildlife shall be responsible for those matters to which this Act applies relating primarily to migratory birds, game management, wildlife refuges, sport fisheries, sea mammals (except whales, seals and sea-lions), and related matters; and the funds and allocations, appropriated or otherwise relating to the matters covered by paragraphs (1) and (2) of this subsection shall be distributed between such Bureaus as the Secretary of the Interior shall determine.

(e) Except as changed by the terms of this Act or by subsequent laws or regulations, all laws and regulations now in effect relating to matters heretofore administered by the Department of the Interior through the former Fish and Wildlife Service as heretofore existing, shall remain in effect.

(f) In recognition of the need for authority to execute the purposes of this Act effectively, the Secretary of the Interior shall exercise such general administrative authority consistently with the terms of this Act as he shall find to be necessary to carry out the provisions of this Act effectively and in the public interest. In order to allow sufficient time to place the reorganizations under this Act into effect, the Secretary is authorized to establish an effective procedure and date of such reorganizations, notice of which shall be published in the Federal Register. Such reorganization shall be accomplished as soon as practicable after the approval of this Act, but not later than ninety (90) calendar days after such approval.

LOAN PROCEDURES

SEC. 4. (a) The Secretary is authorized under rules and regulations and under terms and conditions prescribed by him, to make loans for financing and refinancing of operations, maintenance, replacement, repair, and equipment of fishing gear and vessels, and for research into the basic problems of fisheries.

(b) Any loans made under the provisions of this section shall be subject to the following restrictions:

(1) Bear an interest rate of not less than 3 per centum per annum;

(2) Mature in not more than ten years;

(3) No financial assistance shall be extended pursuant to this section unless reasonable financial assistance applied for is not otherwise available on reasonable terms.

(c) There is hereby created a fisheries loan fund, which shall be used by the Secretary as a revolving fund to make loans for financing and refinancing under this section. Any funds received by the Secretary on or before June 30, 1965, in payment of principal or interest on any loans so made, shall be deposited in the fund and be available for making additional loans under this section. Any funds so received after June 30, 1965, and any balance remaining in the fund at the close of June 30, 1965 (at which time the fund shall cease to exist), shall be covered into the Treasury as miscellaneous receipts. There are hereby

authorized to be appropriated to the fund the sum of $20,000,000 [2] to provide initial capital.

(d) The Secretary, subject to the specific limitations in this section, may consent to the modification, with respect to the rate of interest, time of payment of any installment of principal, or security, of any loan contract to which he is a party.

INVESTIGATIONS, INFORMATION, REPORTS

SEC. 5. (a) The Secretary shall conduct continuing investigations, prepare and disseminate information, and make periodical reports to the public, to the President, and to Congress, with respect to the following matters:

(1) The production and flow to market of fish and fishery products domestically produced, and also those produced by foreign producers which affect the domestic fisheries;

(2) The availability and abundance and the biological requirements of the fish and wildlife resources;

(3) The competitive economic position of the various fish and fishery products with respect to each other, and with respect to competitive domestic and foreign-produced commodities;

(4) The collection and dissemination of statistics on commercial and sport fishing;

(5) The collection and dissemination of statistics on the nature and availability of wildlife, progress in acquisition of additional refuges and measures being taken to foster a coordinated program to encourage and develop wildlife values;

(6) The improvement of production and marketing practices in regard to commercial species and the conduct of educational and extension services relative to commercial and sport fishing, and wildlife matters;

(7) Any other matters which in the judgment of the Secretary are of public interest in connection with any phases of fish and wildlife operations.

TRANSFER OF FUNCTIONS—ASSISTANCE OF OTHER AGENCIES

SEC. 6. (a) There shall be transferred to the Secretary all functions of the Secretary of Agriculture, the Secretary of Commerce, and the head of any other department or agency, as determined by the Director of the Bureau of the Budget to relate primarily to the development, advancement, management, conservation, and protection of commercial fisheries; but nothing in this section shall be construed to modify the authority of the Department of State or the Secretary of State to negotiate or enter into any international agreements, or conventions with respect to the development, management, or protection of any fisheries and wildlife resources or with respect to international commissions operating under conventions to which the United States is a party.

(b) There shall be transferred to the Department of the Interior so much of the personnel, property, facilities, records, and unexpended balances of appropriations, allocations, and other funds (available or to be made available) as the Director of the Bureau of the Budget determines to be necessary in connection with the exercise of any functions transferred to the Secretary pursuant to subsection (a) of this section.

(c) The Secretary may request and secure the advice or assistance of any department or agency of the Government in carrying out the provisions of this Act, and any such department or agency which furnishes advice or assistance to the Secretary may expend its own funds for such purposes, with or without reimbursement from the Secretary as may be agreed upon between the Secretary and the department or agency.

POLICIES, PROCEDURES, RECOMMENDATIONS

SEC. 7. (a) The Secretary of the Interior, with such advice and assistance as he may require from the Assistant Secretary for Fish and Wildlife, shall consider and determine the policies and procedures that are necessary and desirable in carrying out efficiently and in the public interest the laws relating to fish and wildlife. The Secretary, with the assistance of the department staff herein authorized, shall—

(1) develop and recommend measures which are appropriate to assure the maximum sustainable production of fish and fishery products and to prevent unnecessary and excessive fluctuations in such production;

(2) study the economic conditions of the industry, and whenever he determines that any segment of the domestic fisheries has been seriously disturbed either by wide fluctuation in the abundance of the resource supporting it, or by unstable market or fishing conditions or due to any other factors he shall make such recommendations to the President and the Congress as he deems appropriate to aid in stabilizing the domestic fisheries;

(3) develop and recommend special promotional and informational activities with a view to stimulating the consumption of fishery products whenever he determines that there is a prospective or actual surplus of such products;

(4) take such steps as may be required for the development, advancement, management, conservation, and protection of the fisheries resources; and

(5) take such steps as may be required for the development, management, advancement, conservation, and protection of wildlife resources through research, acquisition of refuge lands, development of existing facilities, and other means.

STATE DEPARTMENT—COOPERATION

SEC. 8. (a) The Secretary shall cooperate to the fullest practicable extent with the Secretary of State in providing representation at all meetings and conferences relating to fish and wildlife in which representatives of the United States and foreign countries participate.

The Secretary of State shall designate the Secretary of the Interior or the Assistant Secretary for Fish and Wildlife, or a person designated by the Secretary of the Interior to represent the Department of the Interior, as a member of the United States delegation attending such meetings and conferences and also as a member of the negotiating team of any such delegation.

[2] As amended by Public Law 85-888, Sept. 2, 1958, 72 Stat. 1743.

(b) The Secretary of State and all other officials having responsibilities in the fields of technical and economic aid to foreign nations shall consult with the Secretary in all cases in which the interests of fish and wildlife are involved, with a view to assuring that such interests are adequately represented at all times.

(c) Notwithstanding any other provision of law, the Secretary shall be represented in all international negotiations conducted by the United States pursuant to section 350 of the Tariff Act of 1930, as amended, in any case in which fish products are directly affected by such negotiations.

(d) The Secretary shall consult periodically with the various governmental, private nonprofit, and other organizations and agencies which have to do with any phase of fish and wildlife with respect to any problems that may arise in connection with such fish and wildlife.

REPORTS ON ACTIVITIES AND IMPORTS

SEC. 9. (a) The Secretary of the Interior shall make an annual report to the Congress with respect to activities of the United States Fish and Wildlife Service under this Act, and shall make such recommendations for additional legislation as he deems necessary.

(b) The Secretary is authorized to make a report to the President and the Congress, and, when requested by the United States Tariff Commission in connection with section 7 of the Trade Agreements Extension Act of 1951, as amended (67 Stat. 72, 74), or when an investigation is made under the Tariff Act of 1930 (19 U.S.C. 1332), the Secretary is authorized to make a report to such Commission, concerning the following matters with respect to any fishery product which is imported into the United States, or such reports may be made upon a request from any segment of the domestic industry producing a like or directly competitive product—

(1) whether there has been a downward trend in the production, employment in the production, or prices, or a decline in the sales, of the like or directly competitive product by the domestic industry; and

(2) whether there has been an increase in the imports of the fishery products into the United States, either actual or relative to the production of the like or directly competitive product produced by the domestic industry.

THE RIGHTS OF STATES

SEC. 10. Nothing in this Act shall be construed (1) to interfere in any manner with the rights of any State under the Submerged Lands Act (Public Law 31, Eighty-third Congress) or otherwise provided by law, or to supersede any regulatory authority over fisheries exercised by the States either individually or under interstate compacts; or (2) to interfere in any manner with the authority exercised by any International Commission established under any treaty or convention to which the United States is a party.

AUTHORIZATION FOR APPROPRIATION

SEC. 11. There are hereby authorized to be appropriated such sums as may be necessary to carry out the provisions of this Act.

SEC. 12. (a) The authorization for the transfer of certain funds from the Secretary of Agriculture to the Secretary of the Interior and their maintenance in a separate fund as contained in section 2(a) of the Act of August 11, 1939, as amended July 1, 1954 (68 Stat. 376), shall be continued for the year ending June 30, 1957, and each year thereafter.

(b) Subsection (e) of section 2 of aforesaid Act of August 11, 1939 as amended, is hereby amended to read as follows:

"(e) The separate fund created for the use of the Secretary of the Interior under section 2(a) of this Act and the annual accruals thereto shall be available for each year hereafter until expended by the Secretary."

Approved August 8, 1956.

U.S. DEPARTMENT OF THE INTERIOR,
Washington, D. C.

CODE OF FEDERAL REGULATIONS

TITLE 43—PUBLIC LANDS: INTERIOR

SUBTITLE A—OFFICE OF THE SECRETARY OF THE INTERIOR

PART 8—JOINT POLICY FOR LAND ACQUISITION ON RESERVOIR PROJECTS: DEPARTMENT OF THE INTERIOR-DEPARTMENT OF THE ARMY [1]

Sec. 1. *Lands to be acquired in fee.* The fee title will be acquired to the following lands:

(a) Lands necessary for permanent structures.

(b) Lands below the top of the pool elevation for storing water for navigation, power, irrigation and other conservation purposes.

(c) Fee title in general will be acquired to all land 300 feet horizontally from the edge of the conservation pool described in paragraph 1(b). In those projects where the topography is precipitous, or where the topography is unusually flat, and where such discretionary action is desirable, fee title may be acquired to those lands which are included in the five-year flood frequency rather than 300 feet horizontally.

(d) Additional lands which may be needed to provide for limited public use and reasonable access in accordance with applicable laws, or for operation and maintenance of the project.

(e) Lands covered by the exception noted in paragraph 2(f).

Sec. 2. *Lands for which easements are to be acquired.* Easements will be acquired to the following lands:

(a) Additional reservoir lands needed for flowage in reservoir areas above those described in paragraph 1(c).

(b) Lands in reservoir areas of navigation only projects.

(c) Lands in reservoir areas of flood control only projects which do not provide conservation pools.

(d) Lands required for a relatively short time for temporary structures or for use during the construction period only.

(e) Easements may be acquired for lands in the zone as defined in paragraph 1(c) above the conservation pool, and which are in remote areas of the reservoir or which had previously been subject to frequent inundation, where it is determined that fee title is not required.

(f) Fee title may be taken as necessary where it is to the financial advantage of the Government to acquire fee rather than easement, and in special cases to prevent hardship.

Sec. 3. *Blocking out.* In land acquired in fee, blocking out will be accomplished in accordance with sound real estate practices, for example, on minor sectional subdivision lines; and, normally, land will not be acquired to avoid severance damage if the owner will waive such damage. For lands acquired in easement, close tangents may be used in the upper limit of the easement-held lands; the final easement taking line thereof should generally follow the upper flood line when elevation differences are not significant. Tangents will not be refined to the point they are economically disadvantageous. If more economical easements may be secured on the basis of the right to flood to a prescribed elevation rather than to block out the upper flood line.

Sec. 4. *Mineral rights.* Mineral, oil and gas rights will not be acquired where the owner objects or where a substantial additional cost would be involved, except where mineral development would interfere with operation of the project or except where required by the provisions of the Atomic Energy Act. Mineral rights not acquired will be subordinated to the Government's right to regulate their development in a manner that will not interfere with the primary purposes.

Sec. 5. *Buildings.* Buildings for human occupancy as well as other structures which would interfere with the operation of the project for its primary purposes would be prohibited in the reservoir areas on lands for which an easement is acquired.

Sec. 6. *Acquisition of lands for collateral purposes.* Except as authorized by law, no title to land will be acquired for purposes of preservation of wildlife or forests, restoration or replacement of such values destroyed by reservoirs for creating additional values of like nature, or for recreational purposes.

(a)[2] Supplementary provisions regarding acquisition of lands for recreation and fish and wildlife at Federal reservoir projects:

(1) Federal water storage reservoirs are important elements in the Nation's outdoor recreation and fish and wildlife resources.

(2) Recreation and fish and wildlife opportunities, both present and potential, shall be considered throughout the planning, construction, operation, and maintenance of reservoir projects in cooperation with Federal, State and local governmental agencies having responsibilities relative to public recreation and fish and wildlife. The purpose of this supplement is to assure that when reservoir projects are being formulated for other purposes recreation and fish and wildlife purposes would also be considered and the limited land areas needed to protect and preserve recreation and fish and wildlife potentials will be defined. Recommendations submitted to the Congress will, of course, be subjected to normal Bureau of the Budget review.

(3) The development and utilization of the public recreational and fish and wildlife potentialities shall be a correlative purpose of reservoir projects undertaken by the Federal Government. By correlative purpose is meant that while a reservoir project would not be recommended solely for recreation or fish and wildlife purposes, once it is determined that a reservoir

[1] Published in the Federal Register dated Jan. 15, 1954, with the exception of sec. 6(a) as referred to in footnote 2.

[2] Sec. 6(a)(1)–(6) added by the supplemental agreement published in the Federal Register of Aug. 17, 1959.

project is required for other purposes, then recreation and fish and wildlife purposes will receive parallel consideration in the formulation, design and operation of the project.

(4) The public recreational and fish and wildlife potentialities created by reservoir projects constructed with Federal funds should be protected and preserved for the benefit of the general public and the acquisition of such shore-line lands as are needed for the purpose shall be recommended to the Congress, to the extent such acquisition is justified by the public benefits which would otherwise be foregone.

(5) When acquisition of lands is justified for recreation and fish and wildlife purposes as set forth in paragraph (4) of this section such lands shall be shown separately in reports of project plans to insure that Congress has full information upon which to base a decision as to their inclusion in the project authorization.

(6) The primary responsibility of State and local governmental agencies for providing recreational facilities for their people shall be recognized but the Federal Government should cooperate with the State and local governmental agencies in protecting and preserving recreational opportunities in connection with the construction, maintenance and operation of Federal navigation, flood control, irrigation, or multiple-purpose reservoir projects.

SEC. 7. *Application of policy.*—The policy set forth herein will govern the determination as to acquisition of any tract on which title to the United States has not been vested or a final judgment in condemnation has not been entered except for projects on which the land acquisition program has progressed to the point where application of the policy would be unreasonable or to the distinct disadvantage of the United State or to the general public. The application of the principles and criteria outlined above to lands already acquired for reservoir projects by disposal of fee title to former owners will require Federal legislation. Flowage easements will be retained where necessary. All other lands rendered surplus by this policy will continue to be disposed of in accordance with existing laws.

APPENDIX E

MARINE GAME FISHERIES RESEARCH ACT [1]

AN ACT Authorizing and directing the Secretary of the Interior to undertake continuing research on the biology fluctuations, status, and statistics of the migratory marine species of game fish of the United States and contiguous waters

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Interior is hereby directed to undertake a comprehensive continuing study of the migratory marine fish of interest to recreational fishermen of the United States, including species inhabiting the offshore waters of the United States and species which migrate through or spend a part of their lives in the inshore waters of the United States. The study shall include, but not be limited to, research on migrations, identity of stocks, growth rates, mortality rates, variations in survival, environmental influences, both natural and artificial, including pollution, and effects of fishing on the species, for the purpose of developing wise conservation policies and constructive management activities.

SEC. 2. For the purpose of carrying out the provisions of this Act, the Secretary of the Interior is authorized (1) to acquire lands, construct laboratory or other buildings, purchase boats, acquire such other equipment and apparatus, and to employ such officers and employees as he deems necessary; (2) to cooperate or contract with State and other institutions and agencies upon such terms and conditions as he determines to be appropriate; and (3) to make public the results of such research conducted pursuant to the first section of this Act.

SEC. 3. There are hereby authorized to be appropriated such sums as may be necessary to carry out the provisions of this Act: *Provided,* That no more than $2,700,000 be appropriated for this purpose in any one fiscal year.

Approved September 22, 1959.

---

[1] Public Law 359, 86th Cong., 73 Stat. 642-3